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The Role of Elevated Depressive Symptoms on the Transtheoretical Model Variables in Substance Use Disorders

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The Role of Elevated Depressive Symptoms on the Transtheoretical Model Variables in Substance Use Disorders

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Dedication

To my parents, who have supported me throughout this journey and have always encouraged my curiosity and love of learning. And to my brother, who makes me laugh and reminds me of what is truly important.

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The Role of Elevated Depressive Symptoms on the Transtheoretical Model Variables in Substance Use Disorders

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Depression frequently co-occurs with substance use disorders, which are a severe health and financial burden on our society (Office of National Drug Control Policy, 2011; Office of National Drug Control Policy, 2014). This study examined transtheoretical model of change (TTM) constructs in individuals with elevated depressive symptoms and a comorbid substance use disorder, looking to better understand how the depressive symptoms influenced the individuals' changing substance use behavior.

This study was conducted at the Substance Abuse Research Center in the University of Texas Mental Sciences Institute in Houston, Texas in 2006. Participants (N=138) who met the DSM-IV criteria for cocaine use or dependence disorder were recruited. The sample was 72.2% Black, 19.4% White, and 8.3% Latino. Participants were in one of two treatment conditions for cocaine use disorder: 1) a TTM group intervention, modified for cocaine users, or 2) the control condition, an education and advice group. Data on substance use, TTM constructs, symptoms of behavioral health disorders, and other factors were collected at the beginning of the intervention, the end of

the intervention, and three months post-intervention. Profile analysis and general linear model (GLM) analysis of variance (ANOVA) were used to examine the hypotheses that cocaine users with elevated depressive symptoms would endorse the TTM constructs differently than the nondepressed participants, especially the processes of change constructs, but would reduce their cocaine use the same amount as the nondepressed users.

This study found that participants with elevated depressive symptoms were as successful as nondepressed participants in reducing their cocaine use after treatment. However, participants with elevated depressive symptoms engaged with the TTM variables differently compared to nondepressed participants, especially the processes of change and temptation variables. The behavioral processes of change were significantly lower before treatment and the experiential processes of change were significantly higher after treatment compared to nondepressed participants. Temptation was higher in participants with elevated depressive symptoms compared to nondepressed participants and lower temptation in participants with elevated depressive symptoms was linked to more successful reduction in cocaine use. These findings indicate that temptation and the processes of change are important variables to target in treatment of substance use disorders in adults with elevated depressive symptoms.

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Chapter 1

Introduction

Substance abuse is a major health concern and burden to the economy. Deaths directly related to drugs, such as accidental overdoses, have more than doubled in the last twenty years to 40,000 people (Office of National Drug Control Policy, 2011). Illicit drug use cost the economy almost $200 billion in 2007 through lost productivity, healthcare costs, and criminal justice costs (Office of National Drug Control Policy, 2014). It is imperative that we develop effective substance use interventions in order to address this pressing issue.

A substance use disorder occurs when use of the substance continues despite significant impairment in personal or work life (American Psychiatric Association, 2013). Stimulant use disorder is one type of substance use disorder. Cocaine, the substance that is the focus of the intervention examined in this study, is a type of stimulant that creates an immediate and intense euphoric response (NIDA, n.d.). As tolerance increases, frequent cocaine users must consume greater and greater amounts of cocaine to achieve the same "high," which makes cocaine a highly addictive substance (NIDA, n.d.).

Often adults with stimulant use, similar to other substance use disorders, have depression as well. Comorbidity/dual diagnosis is associated with worse outcomes, including increased suicidal ideation, poorer social functioning, and increased rates of health care utilization compared with those either diagnosed with depression or substance use disorder (Sullivan, Fiellin, & O'Connor, 2005). It is also linked to worse mental and physical health outcomes pre- and post-treatment, and worse social and behavioral functioning in long-term follow-ups when compared with participants without depression

(Burns, Teesson, & O'Neill, 2005; Degenhardt, Hall, & Lynskey, 2001; Grant et al., 2004; Mills et al., 2009; Pettinati, O'Brien, & Dundon, 2013). Numerous treatment studies show that although all participants improve in reducing alcohol consumption, including those who are dually diagnosed, those with comorbid depression begin treatment with a higher level of alcohol consumption and, as a result, continue to use substances at a higher rate after intervention (Burns, Teesson, & O'Neill, 2005; Degenhardt, Hall, & Lynskey, 2001; Grant et al., 2004; Mills et al., 2009; Pettinati, O'Brien, & Dundon, 2013). The complex interaction between depression and substance use, particularly cocaine, and how it pertains to effective intervention, is not well understood. There is even less research on effective intervention with populations that have comorbid stimulant use disorder and depression diagnoses.

One of the most prominent frameworks for understanding the substance use interventions and behavior change is the transtheoretical model of behavioral change (TTM; Prochaska & DiClemente, 1984). This comprehensive biopsychosocial model, integrated from various fields' existing models and concepts of change, conceptualizes change as a dynamic rather than static process (Velicer, Prochaska, Fava, Norman, & Redding, 1998). Variables important to the TTM are the stages of change, decisional balance, temptation, confidence, and the experiential and behavioral processes. A large body of research supports each of these constructs as part of the change process in substance use. The stages of change, for example, describe the development of one's change process, which are characterized by their readiness to change (Marshall & Biddle, 2001; Prochaska, Velicer, DiClemente, & Fava, 1988). The stages are not linear, accounting for relapse and movement in one's readiness to change throughout the change

process (Prochaska, DiClemente, & Norcross, 1992). The experiential and behavioral processes of change are considered the engines of change, propelling individuals through the stages of change (Velasquez, Crouch, Stephens, & DiClemente, 2016). The processes have strong cognitive, affective, and behavioral components that one experiences in order to make lasting behavioral change (Stotts, DiClemente, Carbonari, & Mullen, 1996; Velasquez, Crouch, Stephens, & DiClemente, 2016).

There is little research on the influence of depressive symptoms on the reduction of substance use and other wellness outcomes through the TTM variables (Blume, Schmaling, & Marlat, 2001). As many symptoms of depression influence behavioral change, adults with those symptoms may engage in TTM variables differently than people who are not depressed. Current research shows conflicting results as to how depressed adults compare to nondepressed adults on many of the TTM variables when changing substance use (Blume, Schmaling, & Marlat, 2001; Smith & Tran, 2007; Tsoh & Hall, 2004). Furthermore, there is no research on how depressed adults compare to nondepressed adults on each of the ten experiential and behavioral processes of change, which are constructs within the TTM. As the processes of change have cognitive, affective, and behavioral components, all strongly associated with depression, adults with elevated depressive symptoms may navigate these processes differently than nondepressed adults. A better understanding of how depressive symptoms influence adults' engagement with the TTM variables in substance use interventions would allow these interventions to be targeted to dually diagnosed adults, improving the outcomes for this population.

This study investigated whether adult stimulant users with elevated depressive symptoms seeking to change their behavior were different compared with nondepressed substance users on the TTM variables, whether they reduced their substance use as much as nondepressed substance users, and how adults with elevated depressive symptoms who were successful in reducing substance use compared to those who were not successful. These questions were examined using extant data from a feasibility study completed in 2006 by Dr. Mary Velasquez and colleagues on a National Institutes of Health (NIH) funded TTM-based intervention for substance use (see Appendix A). Participants (N=138) who met the DSM-IV criteria for cocaine use or dependence disorder were placed into groups that were randomly assigned to one of two treatment conditions: 1) a TTM group intervention, modified for cocaine users, or 2) an education and advice group. The sample was 72.2% Black, 19.4% White, and 8.3% Latino. Data on substance use, TTM constructs, symptoms of behavioral health disorders, and other factors were collected at the beginning of the intervention, the end of the intervention, and three months post-intervention.

Chapter 2

Literature Review

Substance abuse in the United States is a major health and economic concern. The Centers for Disease Control and Prevention reported that in 2010 alone more than 40,000 people died of directly drug-related deaths, such as accidental overdose, which is more than double the number of drug-related deaths in 1999 (Office of National Drug Control Policy, 2014). Furthermore, the National Drug Intelligence Center estimated that illicit drug use cost the US economy more than $193 billion in 2007 through lost productivity, healthcare costs, and criminal justice costs (Office of National Drug Control Policy, 2011). These numbers place substance abuse among the major health problems facing the US and suggest that focused intervention is needed to address and ameliorate it.

Substance Use Disorders

Substance use disorders, according to the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-V), occur when an individual continues use of alcohol and/or drugs despite significant impairment in personal or work life (American Psychiatric Association, 2013). This impairment may include health concerns, disability, and an inability to maintain responsibilities at home or at work. There is a wide range of severity of substance use disorders, from mild to severe (American Psychiatric Association, 2013). Multiple studies show that genetic factors influence 40-60% of an individual's risk for addiction (Pace & Samet, 2016). Other factors that may influence the development of a substance use disorder include environmental influences and comorbid psychiatric disorders (Pace & Samet, 2016).

Stimulant use disorder is one type of substance use disorder. Stimulants have a strong physiological impact, increasing alertness, attention, and energy, as well as increasing heart rate, respiration, and blood pressure (National Institute on Drug Abuse [NIDA], n.d.). Cocaine is a powerful stimulant with highly addictive properties (NIDA, n.d.). Derived from the coca plant grown in South America, it is used medically for a few specific purposes but is otherwise illegal in the United States. Generally sold as a white powder, cocaine is snorted, rubbed into the gums, or injected intravenously. It is also sold as a rock crystal that is smoked, referred to as crack (NIDA, n.d.).

Cocaine's highly addictive properties are attributable to its powerful influence on the brain's reward pathways. Cocaine increases the level of dopamine in these pathways, a neurotransmitter that is generally released in response to a pleasurable stimulus, such as eating (NIDA, n.d.). With cocaine use and the subsequent release of dopamine by the neuron into the synapse, dopamine's reuptake is blocked (NIDA, n.d.). This increased level of dopamine between the cells leads to a greater sense of reward, leading to the euphoria that cocaine users experience. However, the reward circuit in the brain quickly accustoms to the higher levels of dopamine, requiring the user to ingest a continually greater amount for the same "high" (NIDA, n.d.).

Initial effects of cocaine are euphoria, high energy, confidence, mental alertness, irritability, paranoia, and hypersensitivity to sight, sound, and touch (American Psychiatric Association, 2013; NIDA, n.d.). These effects appear instantly after using cocaine and wear off quickly, sometimes within a few minutes. Some people report that while using small amounts of cocaine they are still able to carry out everyday tasks, but using large amounts generally leads to aberrant and often dangerous behavior (NIDA,

n.d.). Long-term effects of cocaine include malnourishment, movement disorders (such as Parkinson's disease), and severe paranoia, including auditory hallucinations. Further risks of long-time stimulant use include sexual dysfunction, chaotic behavior, social isolation, and aggressive behavior (American Psychiatric Association, 2013). There are other long-term health risks, depending on how the cocaine is consumed. If snorted, risks include loss of sense of smell, frequent nosebleeds, nasal septal perforations, and problems swallowing. If consumed by mouth, a person may experience severe bowel decay because of reduced blood flow. If consumed through needle injection, the individual is at higher risk for blood-borne infectious diseases, such as HIV and hepatitis B and C (NIDA, n.d.). Cocaine users are at risk for a fatal overdose, especially when used in combination with alcohol and other substances. Consumption of cocaine at high doses can lead to long-term heart dysfunction, heart attack, stroke, or seizure (NIDA, n.d.).

Because of cocaine's influence on the brain's reward circuit, cocaine users are at high risk of becoming addicted, signaled by tolerance, withdrawal, and continued use despite detrimental effects in multiple aspects of life, such as financial, social, occupational, and health. Attempts to reduce cocaine use will likely be accompanied by strongly unpleasant withdrawal symptoms. As the cocaine user's brain has become accustomed to higher levels of dopamine, when users stop consuming cocaine, the lower levels of dopamine lead to symptoms such as depression, fatigue, and slower thinking (NIDA, n.d.).

The many risks to health, impairment of daily life, and cost to individuals and the economy that result from cocaine use disorder require interventions for those addicted

individuals. One challenge facing substance use intervention is comorbid depression. People with substance use disorders often have depression as well, and studies show that those with both disorders have more severe symptomatology and struggle more in maintaining wellness (Pettinati, O'Brien, & Dundon, 2013).

Depression

Depression is a common medical condition, affecting an estimated 16 million adults yearly in the United States (National Institute of Mental Health [NIMH], n.d.; National Alliance of Mental Illness [NAMI], n.d.). Adults with major depressive disorder incurred an economic cost of $210.5 billion in 2010 including direct costs, suicide-related costs, and workplace costs (Greenberg, Fournier, Sisitsky, Pike, & Kessler, 2015). Considering inflation, this is an increase of 21.5% from 2005 (Greenberg et al., 2015). The most devastating impact of depression, which occurs especially when depression is untreated, is suicide. Suicide is the tenth leading cause of death in the United States, accounting for at least 41,000 deaths in 2013 (CDC, n.d.).

Like substance use disorder, depression has a negative impact on daily functioning in various areas of activity such as at work and in an individual's personal life. Depression has a strong genetic component, with heritability of depression up to 40% (American Psychiatric Association, 2013). Other risk factors include substance use, trauma or a traumatic event, and chronic stress or a stressful episode (American Psychiatric Association, 2013). Women are more likely than men to be depressed (American Psychiatric Association, 2013).

Individuals who are depressed experience sadness and/or loss of interest, as well as other symptoms, persistently for at least two weeks (American Psychiatric

Association, 2013). Other symptoms include feelings of guilt, worthlessness, hopelessness, and pessimism; thoughts of death or suicide; trouble concentrating and making decisions; agitation or moving slowly; changes in sleep and appetite; aches and pains; and fatigue (American Psychiatric Association, 2013). These symptoms are implicated in poorer outcomes for comorbid physical and mental health conditions, such as substance use disorders (American Psychiatric Association, 2013).

There is a high prevalence of comorbid depression and substance use disorders (Baker, Thornton, Hiles, Hides, & Lubman, 2012). While there is little information specifically evaluating comorbid depression and cocaine use disorder, many studies have examined comorbid depressive disorders and substance use disorders. Based on two large-scale epidemiological studies in the United States, adults with major depressive disorder have a lifetime prevalence of 40.3% for alcohol use disorder and 17.2% for a drug use disorder (Pettinati, O'Brien, & Dundon, 2013). Adults with alcohol dependence are three to four times more likely than the general population to have a mood or anxiety disorder (Burns, Teesson, & O'Neill, 2005; Degenhardt, Hall, & Lynskey, 2001; Grant et al., 2004; Pettinati, O'Brien, & Dundon, 2013). In treatment settings, this rate is even higher, with one study finding that those seeking treatment for alcohol use disorder had comorbid depression at a rate of 32.8% (Grant et al., 2004).

These co-occurring disorders are associated with multiple negative outcomes. Researchers have found that the symptoms of the individual disorders are more severe when co-occurring, such as increased suicidal ideation, poorer social functioning, and increased rates of health care utilization (Sullivan, Fiellin, & O'Connor, 2005). Multiple treatment studies for alcohol abuse show that while all participants improve in reducing

alcohol consumption, including those with comorbid conditions, those with comorbid conditions have a higher level of alcohol consumption initially and after treatment, worse mental and physical health outcomes, and worse social and behavioral functioning in long-term follow-ups (Mills et al., 2009). Studies on smoking cessation show that adults who have major depressive disorder have higher rates of smoking and struggle more to quit, an effect that is stronger with severe depression (Strong et al., 2012). In sum, when an adult has these co-occurring disorders, it is more difficult to maintain wellness than for individuals with just one of these disorders (Penberthy, Hook, Hettema, Ferrell-Carnahan, & Ingersoll, 2013).

Our current understanding of the complex interaction between these disorders is limited. Depressive symptoms often reduce following abstinence from substance abuse. In these cases, depression is considered secondary to the substance use disorder and requires no further treatment (Burns, Teesson, & O'Neill, 2005). However, Grant et al. (2004) found that a significant number of depressive disorders are independent of substance use, and thus require treatment. Furthermore, substance use is often used as a negative coping strategy for dealing with depressive symptoms. Moderate to severe drinking can reduce the effect of antidepressants, making them ineffective in treating depression, increasing side effects of the medication, and even reducing treatment adherence (Worthington et al., 1996). As an added complication, excessive drinking, especially binge drinking, has been found to be followed by depressive symptoms (Baker et al., 2014).

As the interaction between substance use disorders and depression is complicated and associated with negative effects for the individual and greater society, a better

understanding of the impact of depression on the treatment of substance abuse is needed. With this understanding comes the hope of improving long-term health outcomes for adults with these comorbid disorders. Interventions addressing substance abuse must take into account the powerful impact that comorbid depression can have on changing behavior, health outcomes, and activities of daily living.

Interventions for Cocaine Use

The primary intervention for cocaine use is behavioral, as current medical treatments for cocaine use disorder are limited to a vaccine that is not yet Food and Drug Administration (FDA) approved (Martinez & Trifilieff, 2014). While early research on this vaccine shows promise to aid in abstinence maintenance, studies thus far have found that it does not help those who are initially quitting cocaine use. Because the vaccine binds to consumed cocaine, limiting the body's ability to feel its euphoric effects, but does not change the addiction to cocaine, addicted users generally use more cocaine in order to counteract the effect of the vaccine (Martinez & Trifilieff, 2014). Thus, even with the vaccine, concurrent behavioral intervention is suggested (NIDA, 2015). As only 20% of the population is ready to actively make a change in their detrimental behavior, an intervention that is oriented to address people at various levels of readiness to change is necessary (Miller & Rollnick, 2013). The best-known model of this type is the transtheoretical model of behavior change.

Transtheoretical Model of Behavior Change

The transtheoretical model of behavior change (TTM) was initially developed by Prochaska and DiClemente during the 1980s (Prochaska & DiClemente, 1984). This theory of behavior change is a comprehensive biopsychosocial model, integrating models

and ideas of change from various fields, hence the name "transtheoretical" (Velicer, Prochaska, Fava, Norman, & Redding, 1998). This theory presents behavior change as a dynamic rather than static process, providing a framework for understanding, measuring, and intervening in behavior change throughout the change process, not only when the person is actively pursuing change (Marshall & Biddle, 2001; Velicer et al., 1998).

Stages of change. The research shows that people making changes in their behavior move through various stages of the change process, characterized by their readiness to change (Marshall & Biddle, 2001). The stages of change in the TTM provide a temporal and developmental understanding of behavioral change (Prochaska, Velicer, DiClemente, & Fava, 1988). As these stages are not linear, movement between the stages occurs, including relapse (Prochaska, DiClemente, & Norcross, 1992). These stages are precontemplation, contemplation, preparation, action, and maintenance (DiClemente et al., 1991).

Precontemplation. In the precontemplation stage, people do not have a desire for change. They have no intention of making any steps towards change in the foreseeable future, usually described as the next six months. These individuals may have little to no information about why their behavior is harmful or they may have unsuccessfully attempted change multiple times in the past and so are discouraged about making any future changes. In other theories, these individuals would be considered the "resistant" clients. According to the TTM, individuals with substance use disorders in the precontemplation stage are more aware of the reasons against reducing their use rather than the reasons for it (DiClemente et al., 1991; Prochaska & Velicer, 1997; Velicer, Prochaska, Fava, Norman, & Redding, 1998).

Contemplation. Individuals in the contemplation stage are thinking about making a change, but have made no action towards making a change. They are aware of the benefits of changing their behavior, but are also aware of the cons. Because of this ambivalence, many individuals will remain in this stage for a long time, ruminating on their decision and struggling to move forward with making a behavioral change. Substance users in the contemplation stage have equal considerations of the pros and cons of quitting substance use, leading to rumination and possibly being in this stage for a long period of time (DiClemente et al., 1991; Prochaska & Velicer, 1997; Velicer, Prochaska, Fava, Norman, & Redding, 1998).

Preparation. In this stage, individuals are making plans to change, but have not yet begun the change process. Usually they have made some step towards change, such as seeking help from a health care professional, joining a class, or buying a self-help book. Generally these individuals are successful in action-oriented programs. Individuals with substance use disorders in the preparation stage are seeking help for their disorder or making some other plan to address the problem (DiClemente et al., 1991; Prochaska & Velicer, 1997; Velicer, Prochaska, Fava, Norman, & Redding, 1998).

Action. This is the stage where people have made specific and obvious changes, relieving the negative outcomes of their disorder. In this stage, individuals are actively using change processes. Substance users are reducing or eliminating their illicit substance use, and therefore likely experiencing positive outcomes in their health, personal life, and work (DiClemente et al., 1991; Prochaska & Velicer, 1997; Velicer, Prochaska, Fava, Norman, & Redding, 1998).

Maintenance. This stage occurs after action. Individuals in this stage are still working to maintain their behavior change, but are not having to apply the change processes to the same extent as those in the action stage. These individuals are more confident and experience less temptation than those in the action stage (DiClemente et al., 1991; Prochaska & Velicer, 1997; Velicer, Prochaska, Fava, Norman, & Redding, 1998).

Decisional Balance. This construct describes how an individual weighs the pros and cons of changing their behavior. In the precontemplation stage of the TTM, the decisional balance will be more heavily weighted towards the cons of change, which shifts to balance evenly in the contemplation stage, contributing strongly to the ambivalence present in that stage. In later stages, decisional balance is generally weighted more strongly towards the pros of change (Velicer, Prochaska, Fava, Norman, & Redding, 1998).

Temptation. According to Prochaska and Velicer (1997) three variables are generally involved in the most tempting situations. These are cravings, positive social situations, and emotional distress or negative affect. Temptation is generally high in the beginning of the change process and decreases in later stages of change.

Confidence. This construct describes how strongly a person feels that they can cope with tempting situations without relapsing. This construct generally is low in early stages of change and increases in later stages. Confidence has a moderate negative correlation with temptation: often as confidence increases, temptation decreases. However, it is possible, especially in later stages of change, for one to be highly tempted,

but also highly confident (DiClemente, Carbonari, Montgomery, & Hughes, 1994; Prochaska & Velicer, 1997; Velicer, Prochaska, Fava, Norman, & Redding, 1998).

Processes of change. When individuals attempt to make a change, they go through the experiential and behavioral processes, both overtly and covertly (Velicer, Prochaska, Fava, Norman, & Redding, 1998). These processes of change propel people through the stages of change, acting as the force behind behavior change (Velasquez, Crouch, Stephens, & DiClemente, 2016). Most people who make behavior changes use multiple change processes, whether they are making that change while in treatment or on their own (Velasquez, Crouch, Stephens, & DiClemente, 2016). Stotts, DiClemente, Carbonari, and Mullen (1996) found that in order to make a long-term change, one must engage in these processes. The processes of change are divided into two groups: experiential and behavioral. The experiential processes of change are the cognitions and emotions that people engage in to make a change and the behavioral processes of change are the behaviors, or actions, that contribute to making a change (Velicer, Prochaska, Fava, Norman, & Redding, 1998). Experiential processes are generally used in early stages of change, while behavioral processes are usually used in later stages (Velicer, Prochaska, Fava, Norman, & Redding, 1998). A complete description of the experiential and behavioral processes can be found in Table 1.

The experiential and behavioral processes each have unique contributions to the change process. A large contribution of the experiential processes is one's cognitive and affective awareness and interpretation of aspects of change. For example, consciousness raising, which occurs in the earlier stages of change, is the process of becoming aware of the negative impact of the behavior, as well as ways to change. Self-reevaluation and

environmental reevaluation, which both have strong cognitive and affective components, involve assessments of one's self-perspective and environment, and the impact that the unhealthy behavior has on those domains (Prochaska, Redding, & Evers, 2013). Social liberation is similar to consciousness raising in that it involves increased awareness of the impact of the unhealthy behavior, specifically how reducing the unhealthy behavior relates to greater social opportunities (e.g., not having to leave a restaurant table to go outside and smoke in a nonsmoking restaurant). It is interesting to note that social liberation is an experiential process, but it is also strongly relevant in later stages of change. In the action and maintenance stages, for example, people often change their environment in order to support their new healthier behavior (Velasquez, Crouch, Stephens, & DiClemente, 2016).

Three of the behavioral processes, stimulus control, counter conditioning, and reinforcement management, are strongly intertwined. These processes are based on behavioral theories developed by Pavlov and Skinner (Velasquez, Crouch, Stephens, & DiClemente, 2016). Stimulus control and counter conditioning are based on Pavlov's idea of classical conditioning, where two previously unrelated stimuli are repeatedly paired and so one becomes a trigger for the other. Pavlov's famous example is of food and a bell being paired so that dogs began salivating at the sound of a bell, a previously unrelated stimulus. Using this concept, those in the later stages of change are attempting to countercondition themselves from these connected stimuli. For example, they may change their social environment, since they are often tempted to engage in the behavior they are trying to change when with particular individuals. Skinner's concept of operant conditioning, where the consequences of a behavior (rewards and punishments) influence

whether that behavior is repeated, is the basis for the process of reinforcement management. In this process, reinforcers are modified to encourage behavior change, reducing the previous positive reinforcers of the harmful behavior and creating new rewards for maintaining the healthy behavior. These three processes especially work to modify the triggers and rewards of unhealthy behavior, making the individual more resilient in the face of those triggers and rewards (Velasquez, Crouch, Stephens, & DiClemente, 2016).

Depression, Behavior Change, and the TTM Variables

The research on understanding the influence of depression on the reduction of substance use and other wellness outcomes through the TTM variables is not yet fully understood (Blume, Schmaling, & Marlat, 2001). As many symptoms of depression influence behavioral change, adults with depression appear to engage in TTM variables differently than people who are not depressed. These symptoms include anhedonia (the inability to experience pleasure, which can influence motivation and behavioral activation), hopelessness (a belief that nothing will get better), cognitive distortions (irrational thoughts and beliefs often used to reinforce negative affect states, which can contribute to an irrational understanding of whether behavior change is needed), and rumination (repetitive thinking of factors contributing to one's negative emotional experience, usually cognitive distortions, which can also contribute to thoughts of behavior change as unnecessary) (Beck, Rush, Shaw, and Emery, 1979). Depression is also related to impairments in the processes of self-regulation, which can reduce one's ability to resist temptation (Lovejoy & Heckman, 2014; Velasquez, Carbonari, & DiClemente, 1999). Other factors associated with depression that influence behavior

change include self-efficacy, which is the belief in one's ability to succeed in specific situations (Bandura, 1977) and has been negatively correlated with depression (Kanfer & Zeiss, 1983). Annis and Davis (1988) found that self-efficacy predicts drinking behavior over time.

Multiple studies show that higher levels of depression are associated with greater readiness to change (Blume, Schmaling, & Marlat, 2001; Smith & Tran, 2007). This is likely explained by the TTM model's explanation that motivation increases when the pros of change outweigh the cons (Prochaska & DiClemente, 1982). Psychiatric severity, including depression, has been associated with increased pros of change (Velasquez, Carbonari, & DiClemente, 1999). The negative symptomology of depression may strengthen the pros of change, as dually diagnosed individuals struggle more in their wellness than individuals with either disorder alone (Blume, Schmaling, & Marlat, 2001; Caldwell et al., 2002; Smith & Tran, 2007). Wells-Parker, Dill, Williams, and Stoduto (2006) even found that depression was associated with a greater receptivity to counseling and intervention services, indicating a greater readiness to change.

Even though readiness to change is increased, this does not always result in behavioral changes. Prochaska et al. (2004) found that while depressed smokers overwhelmingly were motivated to quit smoking, only one quarter were interested in making changes in the following month. Furthermore, Velasquez, Carbonari, and DiClemente (1999) found that psychiatric severity is associated with greater temptation as well as more active work to maintain abstinence, possibly explaining why people who are depressed struggle more with substance use relapse.

Other research shows an increasingly complex relationship between depression, reducing substance use, and the TTM variables. Tsoh and Hall (2004), for example, found that depression was not related to the stages of change (although they only measured the precontemplation, contemplation, and preparation stages), and that only depressive symptoms, but not depression, were related to four TTM constructs: 1) pros of decisional balance (these participants valued the pros of smoking more highly and were more ambivalent than peers to make a commitment to quit smoking), 2) temptation (habitual/addictive and negative affect; these participants had more difficulties in resisting smoking in habitual and negative affect situations), and 3) self-reevaluation (these participants had a higher level of self-reevaluation, the experiential process of change referred to in Figure 1, which is particularly important for moving to the action stage of change) (Prochaska, Velicer, Guadagnoli, Rossi, & DiClemente, 1991). The higher endorsement of the pros in decisional balance is in contrast to the previous findings of dually diagnosed participants having a higher readiness to change. Blume, Schmaling, and Marlat (2001) found that while higher depression symptomatology was correlated with increased efforts to reduce alcohol use at baseline, it did not predict changes in drinking over time.

Despite the findings indicating a complex, and sometimes contradictory, interaction between depression and behavior change as explained by the TTM, they also indicate that depression does not prevent individuals from reducing substance use during treatment, although it is still higher than nondepressed adults substance use after treatment. However, as data indicate strong negative long-term wellness outcomes for those with comorbid substance use and depressive disorders, a better understanding is

needed. It is possible that aspects of depression encourage behavior change (such as a higher level of readiness to change) while others counteract it (such as lower self-efficacy and anhedonia). As the TTM provides a strong theoretical base for behavior change, understanding how these factors contribute to behavior change in a dually diagnosed adult within this model is necessary. This knowledge can be used to tailor interventions, focusing specifically on the TTM variables that will best enable the dually diagnosed client to reduce substance use, improve depressive symptoms, and therefore have a better likelihood of long term wellness.

Depression and the Experiential and Behavioral Processes. One possible explanation for the complex interaction of depression and behavior change is the way that depressed adults go through the experiential and behavioral processes. The experiential processes rely heavily on cognitive processes, which might be influenced by cognitive distortions and rumination. The behavioral processes, on the other hand, are strongly influenced by experiences and behavioral activation, both of which are limited by anhedonia. These depressive symptoms add challenges to the already difficult process of reducing substance use. Perhaps depressed adults experience experiential and behavioral processes differently than adults who are not depressed, therefore influencing or explaining the complex interaction of these comorbid disorders. It is even possible that depressed adults experience the processes less than those who are not depressed. As it is necessary to go through the processes to ensure long-term behavior change (Stotts, DiClemente, Carbonari, & Mullen, 1996), no studies have yet examined each of the ten experiential and behavioral processes individually to investigate the influence of depression. As each of the processes may be differentially influenced by depressive

factors, looking at the individual relationships may contribute a more nuanced understanding of behavior change while depressed.

Depression and Other TTM Variables. Other TTM variables are likely involved in creating this complex interaction as well. As discussed above, readiness to change, pros and cons, and temptation have been shown to be experienced differently in depressed adults compared to nondepressed adults. There is no support, as of yet, for a difference in the stages of change between these two groups. However, the studies conducted thus far (Prochaska et al., 2004; Tsoh & Hall, 2004) are limited in their ability to uncover this connection; these studies looked only at the pre-action stages, limiting their range and their ability to find a relationship. This is especially relevant considering that the interaction described above (that of having a high readiness to change, but not having a plan to change in the immediate future) would be directly related to the stages of change, placing many of these individuals in the contemplation stage. In the contemplation stage, ambivalence is high and the pros and cons of making a behavior change are generally equal. It is possible for individuals to remain in this stage, sometimes for many years, ruminating about making a behavior change, but maintaining their problematic behavior at great cost to themselves and society at large (Prochaska & Velicer, 1997; Velicer, Prochaska, Fava, Norman, & Redding, 1998). It is possible that depression may play a role in maintaining this ambivalence, as people who are depressed experience decreased confidence, increased pessimism, and difficulty making decisions, all of which could contribute to an individual's ambivalence. As ongoing research continues to uncover the nuances of the TTM, it would be helpful to gain an increased understanding of the influence of depression on an individual's readiness to change and

stage of change, specifically on the contemplation stage. Therefore, an investigation into the relationship between comorbidity and stages of change, using a scale that measures all stages of change, would add further understanding to this area of research.

Statement of the Problem

Several studies have established that illicit drug use is associated with great wellness and economic cost, on par with other major health problems, requiring focused intervention to address and ameliorate it (Office of National Drug Control Policy, 2011; Office of National Drug Control Policy, 2014). One challenge facing substance use intervention is comorbid depression. People with substance use disorders often have depression, which is implicated in worse mental and physical health outcomes (Mills et al., 2009; Pettinati, O'Brien, & Dundon, 2013). Studies show that while intervention is effective in reducing substance use for those with and without depression, dually diagnosed adults begin treatment with a higher rate of substance use. As a result, dually diagnosed adults continue to use substances at a higher rate after intervention and continue to use substances at a higher rate after intervention (Mills et al., 2009; Pettinati, O'Brien, & Dundon, 2013). A better understanding of how to treat dually diagnosed adults is imperative to improve treatment outcomes for this group.

The TTM is a well-known framework for understanding substance use behavior and response to substance use interventions (Prochaska & DiClemente, 1984). However, how depression impacts the change process is not yet fully understood within the TTM framework. Multiple studies have indicated that people who are depressed report different levels of the various TTM variables, compared to people who are not depressed. For example, multiple studies have found that adults who are depressed have a higher

readiness to change than those who are not depressed (Blume, Schmaling, & Marlat, 2001; Smith & Tran, 2007). In adults who are not depressed, this is associated with moving through the stages of change more quickly; however, adults who are depressed do not change any more quickly than those who are not depressed (Prochaska et al., 2004).

The purpose of this study was to investigate whether adult substance users with elevated depressive symptoms seeking to change their substance use are different compared with nondepressed substance users on the TTM variables, such as processes of change, stages of change, readiness to change, decisional balance, temptation, confidence, and pros and cons. This study also examined how successful adults with elevated depressive symptoms, compared to the nondepressed adults, are at reducing their substance use. Furthermore, this study investigated if adults with elevated depressive symptoms who are more successful at reducing their substance use are different on the TTM variables compared to adults with elevated depressive symptoms who are not successful, as well as what type of intervention adults with elevated depressive symptoms best respond to.

These research questions were investigated using extant data from a feasibility study funded by the National Institute on Drug Abuse (NIDA) completed in 2006 by Dr. Mary Velasquez and colleagues on a TTM intervention for substance use. Participants (N=138) who met the DSM-IV criteria for cocaine use or dependence disorder were recruited from the Substance Abuse Research Center in the University of Texas Mental Sciences Institute in Houston, Texas. Participants were placed into groups that were randomly assigned to one of two treatment conditions: 1) a TTM group intervention,

modified for cocaine users (n=82, six groups total), or 2) an education and advice group (n=56, four groups total). Data on substance use, TTM constructs, behavioral health symptoms, and other factors were collected at the beginning of the intervention, the end of the intervention, and three months post intervention.

Chapter 3

Method

This study was performed using extant data collected in 2006 to assess the feasibility and efficacy of a transtheoretical model (TTM) group treatment substance abuse intervention compared to a traditional education and advice substance abuse intervention (Velasquez, Stotts, von Sternberg, Dodrill, & Carbonari, 2009).

Participants

The parent study included 138 participants. Participants were an average of 40.6 years old. Twenty-four percent of the sample were women and 75.6% were men. The sample was 72.2% Black, 19.4% White, and 8.3% Latino (see Table 2). There were no statistically significant differences between groups on sociodemographic characteristics. Eligible participants were over 18 years old and met the criteria for cocaine-use or dependence. The participants had used cocaine for an average of 14.2 years (see Table 3). Eighty-two of the participants were in the TTM condition (six treatment groups total) and 56 were in the Education-Advice condition (four treatment groups total). Forty-two participants endorsed clinically significant depression symptoms (a *t*-score of 62 or higher) at both intake and post-treatment timepoints. For further sociodemographic, drug, and treatment information see Table 3.

Instrumentation

Brief Symptom Inventory. The Brief Symptom Inventory (BSI; Derogatis, 1993; see Appendix B) is a 53-item self-report measure that uses a 5-point Likert scale to assess psychiatric severity on several domains. This measure is a short form of the Symptom Checklist-90-Revised (SCL-90-R; Derogatis, 1993). The BSI provides a Global

Symptoms Index (GSI) as well as nine subscales, including one for depressive symptoms. The reliability of this measure has been established by many studies, with the reliability of the subscales averaging .7 (Derogatis, 1993). Due to its good psychometric properties and relatively brief administration time, this measure has been used extensively in research studies on addiction, including cocaine, methamphetamines, and ecstasy, as well as for other populations such as residential therapeutic communities, pharmacological studies, and therapy for couples in substance abuse treatment (Wang et al., 2010). Because this study is interested in the change process of adults with elevated depressive symptoms before and after treatment, participants who are above the clinical cutoff score of the BSI at both intake and post-intervention (rather than at only one time point) will be examined as having elevated depressive symptoms (Derogatis, 1993).

Processes of Change Questionnaire. The Processes of Change Questionnaire (PCQ; Prochaska, Velicer, DiClemente, & Fava, 1988; see Appendix C) is a self-report scale that was adapted for this study for cocaine. The PCQ measures the ten experiential and behavioral processes of change on a Likert scale from 1 (never) to 5 (repeatedly). Many studies have established the PCQ's reliability and validity for various behaviors, including multidrug use (Belding, Iguchi, Lamb, & Lakin, 1995). For example, in a sample of cocaine-dependent patients in an outpatient program, the Chronbach Alphas for the experiential subscale was .82 and behavioral subscale was .84 (Stotts, Schmitz, Rhoades, & Grabowski, 2001). The PCQ is used extensively in addiction research and has been adapted for use in weight management interventions (Andrés, Saldaña & Gómez-Bonito, 2011), eating disorder interventions (Geller, Cockell, & Drab, 2001), and

translated and validated for use in other languages (Eeckhout, Francaux, & Philippot, 2012).

Abstinence Self-Efficacy Scale. (ASE; see Appendix D) The Abstinence Self-Efficacy Scale, adapted for this study for cocaine, is a 27-item self-rated scale. This scale measures participants' efficacy to refrain from cocaine use in commonly tempting situations by assessing their confidence to abstain from 1 (not at all confident) to 5 (extremely confident) in each of the various situations. This scale was modified to also assess temptation under the same high-risk situations. Rosenbloom (1991) found that this scale has a high reliability when applied to cocaine, with Chronbach Alphas of the subscale scores ranging from .82 to .88. Many research studies on addiction utilize this measure, and it has been assessed for use with specific groups (Kim, Kim, & Gulick, 2009) as well as translated for use internationally, including in Ghana (Glozah, Adu, & Komesuor, 2015), Germany (Zingg et al., 2009), and Korea (Yang et al., 2017).

Decisional Balance Scale. (See Appendix E) The Decisional Balance Scale measures participants' pros and cons of using cocaine. This measure has two subscales yielding separate scores for the pros of making a behavior change and the cons of making that behavior change. The responses to items in each subscale are added together and divided by six (the number of items in each subscale) to get an average score of both the pros and the cons of the behavior change. This 12-item measure has a high level of internal consistency when applied to cocaine; based on the findings of Prochaska, et al., (1994), the Chronbach Alpha of the Pros subscale is .86 and of the Cons subscale is .87. This scale has been adapted for multiple uses including with adolescent populations (Guo, Aveyard, Fielding, & Sutton, 2009), when translated to Chinese (Chen, Sheu,

Percy, Brown, & Yang, 2006), and when translated to Turkish (Bektas, Ozturk, & Armstrong, 2010).

University of Rhode Island Change Assessment Scale. The University of Rhode Island Change Assessment Scale (URICA; McConnaughy, Prochaska, & Velicer, 1983; see Appendix F) is a 28-item questionnaire widely used in addiction literature (Tambling & Ketring, 2014) and modified for cocaine in this study. It is a self-report measure, which operationally defines four of the TTM stages: precontemplation, contemplation, action, and maintenance. The scale has established reliability in multiple samples [in a sample from DiClemente and Hughes (1990), the Chronbach Alphas ranged from .69 to .82 and in the Project MATCH sample (Carbonari & DiClemente, 2000) the Chronbach Alphas ranged from .68 to .85] and among a wide array of studies assessing addiction and substance use disorders (Field, Adinoff, Harris, Ball, & Carroll, 2009).

Timeline Follow-Back. The Timeline Follow-Back (TLFB; Sobell & Sobell, 1996, 1980; see Appendix G) is a structured interview that assesses past drug and alcohol use for each day of the assessment period. This interview uses a calendar to facilitate enhanced recall of past drug use behavior and has established reliability and validity in alcohol and drug-using populations (Fals-Stewart et al., 2000; Sobell & Sobell, 1980). This measure has been used and evaluated extensively since its development in the 1970s and has been shown to have excellent psychometric properties in diverse settings (Sobell, Brown, Leo, & Sobell, 1996). Percent days use (PDU) for alcohol and cocaine was derived from the data collected from this measure.

Procedures

Recruitment of participants. Participants were recruited at a university-based outpatient substance use disorders clinic. Recruitment was done through newspaper ads, radio ads, flyers, brochures, and letters sent to mental health professionals indicating that treatment was available. An intake assessment was completed when participants were recruited. This included providing information on the study and gathering demographic information, personal history, and degree of cocaine and other substance use. Participants were then assigned to the next available group, which was randomized into either the TTM or the Education-Advice conditions. On average, the group began thirteen days after participant intake.

Intervention and data collection. Groups in each of the conditions met two times per week for six weeks for a total of twelve 90-minute sessions. Participants were assessed on all measures at intake, post-treatment (three months post-intake), and follow-up (three months post-intervention). Two experienced masters or doctoral level therapists led each group and remained with the group for all twelve sessions of treatment. For both conditions, the therapists were highly trained in the respective interventions by the research team. Training for the TTM group leaders included learning about the TTM, especially the processes of change (POC), the treatment protocol, and practicing the various techniques including role plays. More emphasis was placed on process, rather than education or advice in the TTM group. Training for the control group leaders included emphasizing a didactic style in the group and allowing discussion of the treatment materials. Education and advice were emphasized in the control group. The principal investigator reviewed recordings of the sessions to ensure treatment fidelity and

provided weekly supervision for the therapists. Furthermore, after each session therapists and participants completed evaluation forms to evaluate treatment fidelity and therapist competence.

TTM intervention. The manual for the TTM group was derived from Group Treatment for Substance Abuse: A Stages-of-Change Therapy Manual (first edition published in 2001; Velasquez, Gaddy Maurer, Crouch, & DiClemente, 2001). This intervention was modified by a group of TTM experts to be a twelve-session group therapy intervention for cocaine use focused on the processes of change. This treatment promotes change through focus on the processes of change: the first six sessions focus on the experiential processes and following six sessions focus on the behavioral processes. The techniques in this intervention are modified from other systems of therapy, specifically MI and CBT, but also psychoeducation, values clarification, relapse prevention, and social skills training.

Education-advice intervention. The Education-Advice group manual was based on traditional outpatient intervention strategies for building skills to successfully reduce cocaine use. Each session was composed of both a didactic and a discussion component; clients were taught the new concepts then discussed how it related to their own cocaine use. Session content included an introduction to the biopsychosocial model of addiction and symptoms associated with cocaine use, defense mechanisms, social support, effects of cocaine on the brain, the disease model, negative consequences, stages of recovery, nutrition, codependency, HIV and cocaine abuse, and job finding strategies.

Findings from the feasibility study. The original study found that participants in both conditions significantly reduced cocaine use from 47% days use at baseline to 27%

during treatment and 23% three months post-treatment (Velasquez, Stotts, von Sternberg, Dodrill, & Sampson, 2009). While overall there was no difference between treatment groups, the study did find that depending on the participant's stage of change, they reduced their cocaine use more in the treatment group than in the control group. That is, if they were in an earlier stage of change upon entering into the study (precontemplation or contemplation) they reduced their cocaine use more in the TTM group, while if they were in a later stage of change they reduced their cocaine use more in the education-advice intervention group. The researchers proposed that substance use intervention is most effective when targeting processes of change that are congruent with the readiness to change of the individual. That is, if the participant has little motivation to change and is in the precontemplation stage at baseline then there would likely be a great benefit from an intervention that strongly addresses the processes of change. However, if the participant is motivated and in the action stages of change, then advice and psychoeducation on how to make the change would likely be more beneficial and produce a greater amount of change.

Analyses

Preliminary Analyses. Descriptive statistics (means, ranges, standard deviations, minimum and maximum values) were calculated for each of the criterion variables. The independence assumption was violated in this study as participants were in groups together over time and therefore influenced one anther, resulting in shared variance in their outcomes. To ensure that no other assumptions were violated, the data was assessed for approximate normality of distribution, outliers, and sphericity.

Research Question 1: How do adults with and without elevated depressive symptoms differ on TTM variables?

Hypothesis 1a: Adults with elevated depressive symptoms have statistically significantly different profiles for the processes of change compared to adults who are not depressed.

Rationale: Symptoms of depression such as cognitive distortions and anhedonia make it difficult for adults with elevated depressive symptoms to navigate the experiential (which has strong cognitive and affective components, both associated with depression) and behavioral processes (which could be hindered by anhedonia and hopelessness).

Analysis: The subscale scores (converted to t-scores) on the PCQ of adults with elevated depressive symptoms were compared to the subscale scores on the PCQ of nondepressed adults through three separate profile analyses at the three time points (intake, post-treatment, and follow-up). Profile analysis is a special case of multivariate analysis of variance (MANOVA) used when there are multiple dependent variables all measured on the same scale (Tabachnick & Fidell, 2013). This method is typically used to determine whether groups have similar profiles on a set of measures, such as the subscales of the PCQ. Profile analysis is robust to the violation of the independence assumption, which occurs in group interventions such as in this study. See Figure 2 for an example of profile analysis from Carbonari and DiClemente (2000). Three types of hypotheses are examined in profile analysis: parallelism, overall difference, and flatness (Tabachnick & Fidell, 2013). Parallelism tests whether the different groups have parallel profiles; in univariate repeated-measures analysis of variance (ANOVA), this would be

considered a test of interaction. Overall difference, or the levels hypothesis, is the question regarding whether the groups, regardless of parallel profiles, have different average scores on the collected measures (Carbonari & DiClemente, 2000; Tabachnick & Fidell, 2013). The final question, flatness, concerns whether the dependent variables all elicit the same or similar responses, independent of the groups. Parameter estimates were used to determine if the groups had significantly different scores on the individual variables.

Hypothesis 1b: Adults with elevated depressive symptoms endorse higher contemplation stage ratings at post-treatment and follow-up compared to those who are not depressed.

Rationale: Adults with elevated depressive symptoms have fewer emotional resources and so struggle with initiating change.

Analysis: Repeated-measures ANOVA was used to compare the mean score of adults with elevated depressive symptoms on the Contemplation subscale of the URICA to that of nondepressed adults at intake, post-intervention, and follow-up time points. Repeated-measures ANOVA, also referred to as within-subjects ANOVA, is used to compare groups consisting of the same participants on a dependent variable across multiple time-points. The error term in repeated-measures ANOVA factors in the variability of the individual participants, as well as the variability between groups, to account for the individual differences in the participants (Tabachnick & Fidell, 2013).

Hypothesis 1c: Adults with elevated depressive symptoms are statistically significantly higher on temptation, pros of change, and contemplation; lower on confidence; and similar on the other variables compared to nondepressed adults.

Rationale: Adults with elevated depressive symptoms are less likely to have the emotional resources to resist temptation and have worse symptomology than non-dually diagnosed adults making them more interested in changing. They also tend to have lower self-efficacy, which is associated with confidence.

Analysis: Using profile analysis, as described in the analysis of Hypothesis 1a, the mean scores of adults with elevated depressive symptoms, converted to T-scores, from the ASE, the ASE modified for temptation, the subscales of the URICA, and the subscales of the Decisional Balance Scale were compared to those nondepressed individuals. A profile analysis was performed at each time-point (intake, post-intervention, and follow-up).

Research Question 2: Do people with elevated depressive symptoms reduce their substance use as much as people who are not depressed?

Hypothesis: There is no statistically significant difference in substance use reduction between adults with elevated depressive symptoms compared to adults who are not depressed.

Rationale: Findings from previous studies (Blume, Schmaling, & Marlat, 2001; Mills et al., 2009) indicate that depressed adults and nondepressed adults reduce substance use the same amount after treatment.

Repeated Measures ANOVA, as described in the analysis of Hypothesis 1b, was used to compare the percent days use of cocaine (PDU; as informed by the TLFB) of people with elevated depressive symptoms and people who are not depressed at three time-points: intake, post-intervention, and follow-up.

Research Question 3: What is the TTM variable profile of adults with elevated depressive symptoms who are more successful at reducing cocaine use compared to those who are less successful at reducing cocaine use at follow up?

Hypothesis: More successful adults with elevated depressive symptoms are statistically significantly lower on temptation and higher on confidence and the processes of change compared to those who are less successful.

Rationale: Those adults with elevated depressive symptoms who have higher confidence, lower temptation, and more processes of change use are more able to enact and maintain behavior change.

Adults with elevated depressive symptoms who at the follow-up time point abstained from cocaine use, used moderately (less than ten PDU), and used heavily (more than ten PDU) were compared to each other. The groups were compared using profile analysis, as described in the analysis of Hypothesis 1a, on the mean scores of the TTM variables (temptation, confidence, pros and cons, stages, and processes of change) converted to T-scores.

Research Question 4: Which treatment condition is more effective in reducing cocaine use in adults with elevated depressive symptoms?

Hypothesis: Adults with elevated depressive symptoms have a statistically significant greater reduction in cocaine use in the TTM group, compared with adults with elevated depressive symptoms in the Education-Advice group.

Rationale: The TTM group provides more focus on the processes of change, providing adults with elevated depressive symptoms more opportunity to engage with them and thus more opportunity to change.

Repeated Measures ANOVA, as described in the analysis of Hypothesis 1b, was used to compare the PDU of cocaine of depressed adults in the TTM group to depressed adults in the Education-Advice group at each of the time-points.

Chapter 4

Results

Preparation of the data, calculation of descriptive statistics, checking assumptions, profile analyses, and general linear model (GLM) analysis of variance (ANOVA) were conducted using SPSS 23.

Preliminary Analyses

Descriptive statistics (means, ranges, standard deviations, minimum, and maximum values) were calculated for each of the criterion variables (see Tables 5 through 8). As participants were in groups together over time and therefore influenced one another, resulting in shared variance in their outcomes, the independence assumption was violated in this study. To ensure that no other assumptions were violated, the data were assessed for approximate normality of distribution, outliers, and sphericity. Inspection of frequency distributions, histograms, and box plots yielded no outliers. Sphericity was assessed with each univariate ANOVA analysis. The normal distribution of continuous variables was determined by: (a) the normal curves for each variable observed in the histograms, (b) the skew values for each variable, and (c) the kurtosis values for each variable (Kim, 2013). No violations of normality were found. Finally, intraclass correlations (ICC) were performed to detect any variation between the intervention groups, as the treatment was delivered through group interventions. The ICCs indicated high reliability between the groups. The average measure ICC of all of the transtheoretical model (TTM) variables, including the experiential and behavioral processes of change, was .897 with a 95% confidence interval from .775 to .970 [$F(9,171)=9.732$, $p<.001$)]. The average measure ICC for just the experiential processes

of change was .891 (9,36)=.891 with a 95% confidence interval from .727 to .969 [$F(9,36)=9.138$, $p<.001$) and for the behavioral processes of change it was .960 with a 95% confidence interval from .903 to .989 [$F(9,45)=24.983$, $p<.001$). In sum, all statistical assumptions required for repeated measures ANOVA and profile analysis were met.

Primary Analyses: Tests of Research Questions

This quantitative experimental study examined the differences in multiple TTM variables between participants with elevated depressive symptoms and nondepressed participants in an intervention to reduce cocaine use. The results of the following research questions are presented below. For all comparisons, significance was achieved if the *F* ratio met or exceeded the .05 level.

Research Question 1. How do adults with elevated depressive symptoms differ on TTM variables compared to nondepressed adults?

Hypothesis 1a: Adults with elevated depressive symptoms have statistically significantly different profiles for the processes of change compared to adults who are not depressed.

Results: A profile analysis was performed on the 11 processes of change (POC subscales) of the Processes of Change Questionnaire (PCQ; social liberation was divided into experiential and behavioral subscales). The grouping variable was elevated depressive symptoms, operationalized by whether the participants were above the cutoff for the depression subscale of the Brief Symptom Inventory (BSI) at the beginning and at the end of treatment. This analysis was done at three time points: pre-treatment, post-treatment, and at the three-month follow-up. Pre-treatment (see Figure 3), using Wilks'

Lambda, the profiles did not significantly deviate from parallelism, $F(10,99)=1.506$, $p=.148$, that is, the profile of the two groups did not significantly deviate from one another. Post-treatment profiles (see Figure 4) and treatment profiles at the three-month follow-up time point (see Figure 5) did significantly deviate from parallelism, $F(10, 90)=2.340$, $p=.017$, $\eta^2=.206$ and $F(10, 88)=2.027$, $p=.040$, $\eta^2=.187$ respectively. This indicates that participants with elevated depressive symptoms and those without elevated depressive symptoms used the processes of change differently at the end of treatment and again three months later.

The other hypotheses tested in profile analysis, the levels and flatness hypotheses, were not significant at all three time points. The flatness hypothesis tests whether the dependent variables all elicit the same or similar responses, independent of the groups. For this test sphericity was violated at all three time points so the Greenhouse-Geisser correction was used [pre-treatment $F(1, 8.213)=0.239$, $p=.985$, post-treatment $F(1, 6.937)=0.104$, $p=.998$, and three-month follow-up $F(1, 6.183)=.258$, $p=.959$]. The levels hypothesis tests whether the groups on average have different scores (i.e. a univariate analyses testing the difference in the Grand Means) on the collected measures. These findings were not significant [pre-treatment $F(1, 108)=0.50$, $p=.823$, post-treatment $F(1, 99)=.024$, $p=.876$, and three-month follow-up $F(1, 97)=1.670$, $p=.199$].

To investigate differences in the individual variables at each time point parameter estimates were used. These indicated that at intake the individual processes of change reinforcement management, $t(109)=1.983$, $p=.05$, $\eta^2=.035$, and helping relationships, $t(109)=2.193$, $p=.035$, $\eta^2=.041$, were significantly different between participants with and without elevated depressive symptoms. These are both behavioral processes of change.

Parameter estimates at post-treatment indicated that reinforcement management, a behavioral process of change, was significantly different between participants with and without elevated depressive symptoms, $t(100)=2.448$, $p=.016$, $\eta^2=.057$. Finally, parameter estimates indicated that at follow-up consciousness raising, $t(98)=-2.031$, $p=.045$, $\eta^2=.041$, self reevaluation, $t(98)=-2.007$, $p=.006$, $\eta^2=.076$, and environmental reevaluation $t(98)=2.004$, $p=.006$, $\eta^2=.074$, were significantly different between participants with and without elevated depressive symptoms. These are all experiential processes of change. Before and after treatment the differences between participants with and without elevated depressive symptoms on individual variables were restricted to behavioral processes of change, however at the three-month follow-up, they were different on several experiential processes of change. At follow-up when nondepressed participants were utilizing more behavioral processes of change, which are generally utilized further along in the stages of change, participants with elevated depressive symptoms were still strongly utilizing the experiential processes of change, especially consciousness raising, self-reevaluation, and environmental reevaluation. These findings support the hypothesis that adults with elevated depressive symptoms have significantly different profiles compared to nondepressed adults on the processes of change.

Hypothesis 1b: Adults with elevated depressive symptoms endorse higher contemplation stage ratings at post-treatment and follow-up compared to those who are not depressed.

Results: A GLM repeated-measures was performed on the contemplation stage subscale of the University of Rhode Island Change Assessment Scale **(**URICA) at intake, post-treatment, and three-month follow-up time points. The grouping variable was

elevated depressive symptoms, operationalized as described in the results for hypothesis 1a. Mauchly's test of sphericity indicated it was not violated (p=.444). There was no significant interaction effect, F(2,176)=.961, p=.384, no significant effect of time, F(2,176)=.210, p=.811, and no main effect, F(1,88)=.130, p=.719. This indicates that the participants with elevated depressive symptoms had similar scores on the contemplation subscale compared to the nondepressed participants and there was no difference between the groups over time. These findings do not support the hypothesis, and instead indicate that participants with and without elevated depressive symptoms had similar endorsement of the contemplation stage over time.

Hypothesis 1c: Adults with elevated depressive symptoms are statistically significantly higher on temptation, pros of change, and contemplation; lower on confidence; and similar on the other variables compared to nondepressed adults.

Results: A profile analysis was performed on the TTM variables (experiential processes, behavioral processes, temptation, confidence, pros of change, cons of change, precontemplation stage of change, contemplation stage of change, and action stage of change) with the grouping variable elevated depressive symptoms. This analysis was done at three time points: pre-treatment, post-treatment, and at the three-month follow-up. At the first two time points, the profiles (see Figures 6 and 7) did not significantly deviate from parallelism [intake F(8,101)=1.493, p=.169; post-treatment F(8,91)=1.680, p=.114]. However, at the three-month follow-up (see Figure 8), the profiles did significantly deviate from parallelism, F(8, 84)=2.834, p=.008, η^2=.213. Participants with and without elevated depressive symptoms endorsed the TTM variables in a similar

way at the first two time points, but engaged in the TTM variables differently three months after treatment.

The flatness and levels hypotheses were not significant in this profile analysis. For the flatness hypothesis, sphericity was violated at all three time points so the Greenhouse-Geisser correction was used [pre-treatment $F(1, 5.729)=0.241$, p=.959; post-treatment $F(1, 4.902)=.054$, $p=.998$; and three-month follow-up $F(1, 4.602)=.095$, $p=.990$]. The levels hypothesis was also not significant at each time point [pre-treatment $F(1,108)=.885$, $p=.349$; post-treatment: $F(1,98)=.090$, $p=.765$; and three-month follow-up: $F(1,91)=.313$, $p=.577$].

An investigation between the individual TTM variables through parameter estimates showed that temptation was significantly higher in participants with and without elevated depressive symptoms at the pre-treatment and post-treatment time points [intake $t(109)=-3.169$, $p=.002$, $\eta^2=.085$; post-treatment $t(99)=-2.456$, $p=.016$, $\eta^2=.058$]. At the three-month follow-up, parameter estimates indicated participants with elevated depressive symptoms used experiential processes significantly more than nondepressed participants, $t(92)=-2.273$, $p=.025$, $\eta^2=.054$. Participants with elevated depressive symptoms endorsed higher levels of temptation for using cocaine compared to nondepressed participants at the first two time points, then three months after treatment were more engaged with the experiential processes of change. These findings partially support the hypothesis; temptation was higher in participants with elevated depressive symptoms at two time points, but pros of change, contemplation, and confidence were similar between the two groups.

Research Question 2: Do people with elevated depressive symptoms reduce their substance use as much as people who are not depressed?

Hypothesis: There is no statistically significant difference in substance use reduction between adults with elevated depressive symptoms compared to adults who are not depressed.

Results: A GLM repeated measures was performed on the percent days use of cocaine score derived from the Timeline Follow-Back (TLFB) at intake, post-treatment, and three-month follow-up time points. The grouping variable was elevated depressive symptoms, operationalized as described in the results for hypothesis 1a. Mauchly's test indicated that sphericity was violated (p=.000) so a multivariate analysis of variance (MANOVA) was performed. No significant interaction, $F(2,93)=1.678$, p=.191, or main effect were found, $F(1,94)=.184$, p=.669, but there was a significant effect of time, $F(2,93)=18.652$, p=.000, η^2=.286. Cocaine use for all participants decreased over the course of the study, and there was no difference in reduction between participants with and without elevated depressive symptoms, as hypothesized.

Research Question 3: What is the TTM variable profile of adults with elevated depressive symptoms who are more successful at reducing cocaine use compared to those who are less successful at reducing cocaine use at follow up?

Hypothesis: More successful adults with elevated depressive symptoms will be statistically significantly lower on temptation and higher on confidence and the processes of change compared to those who are less successful.

Results: A profile analysis was performed on the TTM variables. The grouping variable was the success of adults with elevated depressive symptoms in reducing their

cocaine use, operationalized by whether the participants with elevated depressive symptoms reported abstaining from cocaine use at follow up, reported a percent day use (PDU) of cocaine greater than zero and less than ten percent, or reported a PDU of cocaine greater than ten percent. Profile analysis was done at three time points: pre-treatment, post-treatment, and at the three-month follow-up. Of the adults with elevated depressive symptoms, eight were successful at eliminating cocaine use (abstaining group), 13 reported greater than zero and less than ten percent PDU (moderate use group), and 17 reported greater than ten percent PDU (heavy use group).

At all time points, the profiles did not significantly deviate from parallelism [intake $F(16,54)=.933$, $p=.539$; post-treatment $F(16,54)=.802$, $p=.677$; and at follow up $F(16,50)=.930$, p=.542]. The flatness hypothesis and levels hypothesis were not significant at all three time points, as well [flatness: pre-treatment $F(8, 27)=.890$, $p=.538$, post-treatment $F(8, 27)=.802$, $p=.677$, and three-month follow-up $F(8,25)=1.684$, $p=.152$; levels: pre-treatment $F(2,34)=1.091$, $p=.347$; post-treatment: $F(2,34)=.799$, $p=.458$; and three-month follow-up: $F(2.32)=1.006$, $p=.377$].

There were significant findings when examining each TTM variable individually, however, specifically on behavioral processes and temptation. Pre-treatment [$t(36)=2.135$, $p=.040$] and follow-up [$t(36)=2.118$, $p=.036$] parameter estimates indicated that the behavioral processes were significantly different between the abstaining, moderately-using, and heavily-using groups. At follow-up, the abstaining group used the behavioral processes the most, while the heavy-use group used them the least. Follow-up parameter estimates also indicated that temptation was lowest among the abstaining group and highest among the heavy use group, $t(36)=-2.365$, $p=.024$. While the profiles

of the groups were not different, the hypothesis was partially supported in that temptation and processes of change were different between the groups.

Research Question 4: Which treatment condition is more effective in reducing cocaine use in adults with elevated depressive symptoms?

Hypothesis: Adults with elevated depressive symptoms will have a statistically significant greater reduction in cocaine use in the TTM group, compared with those in the Education-Advice group.

Results: A GLM repeated-measures was performed on the percent days use (PDU) score derived from the TLFB at intake, post-treatment, and three-month follow-up time points of the participants with elevated depressive symptoms. The grouping variable was the treatment condition. Sixteen participants with elevated depressive symptoms were in the Education and Advice treatment condition and 22 were in the TTM treatment condition. Mauchly's test indicated that sphericity was violated (p=.000) so a MANOVA was used. No significant interaction (see Figure 9), $F(2,93)=1.687$, p=.191, or main effect was found, $F(1,36)=.260$, p=.613, but there was a significant effect of time, $F(2,93)=18.652$, p=.000, $\eta^2=.286$. This indicates that participants with depressive symptoms all reduced their cocaine use over the course of treatment, regardless of their treatment condition, which does not support the hypothesis.

Summary

The processes of change profiles of participants with and without elevated depressive symptoms were significantly different at post-treatment and follow-up time points. Parameter estimates indicated that participants with elevated depressive symptoms utilized behavioral processes of change less often than nondepressed

participants at intake and post-treatment, especially reinforcement management and helping relationships. At follow-up, the participants with elevated depressive symptoms were using the behavioral processes similarly to the nondepressed participants, but were using experiential processes much more, especially consciousness raising, self-reevaluation, and environmental reevaluation.

On the other TTM variables, participants with and without elevated depressive symptoms had significantly different profiles at follow up. Participants with elevated depressive symptoms also had significantly higher scores on temptation at intake and post-treatment. Participants with elevated depressive symptoms also used the experiential processes significantly more than nondepressed participants at follow-up. There were no other significant differences between participants with and without elevated depressive symptoms, including no significant difference on the contemplation subscale.

Overall, cocaine use decreased significantly over the course of the study, and there was no significant difference in cocaine reduction for participants with and without elevated depressive symptoms. Furthermore, adults with elevated depressive symptoms all reduced their cocaine use over the course of treatment, regardless of their treatment condition. The participants with elevated depressive symptoms who were most successful in eliminating cocaine use had significantly lower temptation and used the behavioral processes of change most at follow-up compared to the moderately-using group and the heavily-using group.

Chapter 5

Discussion

Cocaine and other illicit drug abuse is a severe health and financial burden on our society (Office of National Drug Control Policy, 2011; Office of National Drug Control Policy, 2014). Depression frequently co-occurs with substance use disorders. Current drug abuse treatment, while it does reduce substance abuse, still results in a higher rate of substance use after intervention in dually diagnosed individuals compared to nondepressed adults, as well as worse mental and physical health outcomes for dually diagnosed compared to nondepressed adults (Mills et al., 2009; Pettinati, O'Brien, & Dundon, 2013). These outcomes include increased suicidal ideation, poorer social functioning, and increased rates of health care utilization (Sullivan, Fiellin, & O'Connor, 2005). As many symptoms of depression influence behavioral change, adults with these symptoms may engage in substance abuse treatment differently than people who are not depressed. An improved understanding of this dually diagnosed population will help improve treatments and ameliorate the impact of these comorbid diagnoses.

The transtheoretical model of change (TTM) framework is frequently used for understanding substance use behavior change and response to substance use interventions, but there is limited information regarding the effect of depression on these processes (Prochaska & DiClemente, 1984). This study investigated how adults with elevated depressive symptoms and cocaine addiction navigate changing addiction behavior according to TTM constructs, particularly the processes of change. The other TTM constructs included temptation to use, confidence to abstain, pros of change, cons of change, the precontemplation stage, the contemplation stage, the action stage, and the maintenance stage. It also examined whether they reduce their substance use as much as

nondepressed substance users, and how adults with elevated depressive symptoms who are successful in reducing substance use compare to those who are not successful. It was hypothesized that cocaine users with elevated depressive symptoms would endorse the TTM constructs differently than the nondepressed ones, especially the processes of change, but would reduce their cocaine use the same amount as the nondepressed users. These questions were examined using profile analysis and general linear model (GLM) analysis of variance (ANOVA) on extant data from a stage 1 study completed in 2006 by Dr. Mary Velasquez and colleagues on a TTM intervention for substance use. Results found that participants with elevated depressive symptoms did use the processes of change differently compared to the nondepressed participants, while reducing their cocaine use the same as the nondepressed participants.

Participants with and without Elevated Depressive Symptoms Used the Processes of Change Differently in Treatment for Stimulant Use Disorder

Previous studies that have investigated how comorbidity influences alcohol abuse treatment have showed that all participants improve in reducing alcohol consumption, including those who are dually diagnosed, however those with comorbid depression begin treatment with a higher level of alcohol consumption, so still have a have a higher level of alcohol consumption after treatment (Mills et al., 2009). Similarly, this study found that both the participants with and without elevated depressive symptoms reduced their cocaine use by the end of treatment and maintained that reduced level of use through the three-month follow-up. Furthermore, participants with elevated depressive symptoms responded similarly to the TTM intervention and the psychoeducation

intervention. In each treatment, depressive symptoms did not prevent the participants from successfully reducing their cocaine use.

However, engagement with the processes of change was different between the participants with and without elevated depressive symptoms in this study, especially after treatment. As the processes of change (see Table 1) are considered the "machine" of change in the TTM and must be engaged in to maintain lasting change (Stotts, DiClemente, Carbonari, & Mullen, 1996; Velasquez, Crouch, Stephens, & DiClemente, 2016), this difference might explain the more severe long-term treatment outcomes of dually diagnosed compared to nondepressed substance abusers (Sullivan, Fiellin, & O'Connor, 2005).

The use of experiential compared to behavioral processes of change was different between participants with and without elevated depressive symptoms. There are ten processes of change, five of which are experiential and five behavioral. The experiential processes of change have cognitive and affective components while the behavioral processes of change require behavioral engagement (Velasquez, Crouch, Stephens, & DiClemente, 2016; Velicer, Prochaska, Fava, Norman, & Redding, 1998). As the experiential processes of change are more thought driven, they are typically used during the early part of behavior change when a person is debating whether to make a change or not (Velicer, Prochaska, Fava, Norman, & Redding, 1998; see Figure 1). The behavioral processes, on the other hand, are more active processes, such as changing one's environment or substituting new behaviors for the one they are attempting to change. These are typically used during later stages of change when one is preparing for or actually making the change (Velicer, Prochaska, Fava, Norman, & Redding, 1998).

However, in this study participants with elevated depressive symptoms were still engaging in experiential processes of change three months after ending treatment, a time point when most participants had successfully reduced or eliminated their cocaine use and maintained that change for three months. This is not typical of the use of the processes of change (Velicer, Prochaska, Fava, Norman, & Redding, 1998).

In contrast, at this same time point participants with elevated depressive symptoms who were more successful at reducing their substance use were using the behavioral processes more than those who were using cocaine moderately or heavily. This is consistent with the pattern of use of the processes of change established in TTM literature (Velicer, Prochaska, Fava, Norman, & Redding, 1998). This indicates that the increased engagement with experiential processes late in behavior change has implications for unsuccessful behavior change. As atypical engagement with the processes of change is associated with an inability to maintain the new behavior over time (Stotts, DiClemente, Carbonari, & Mullen, 1996), this engagement pattern may explain the difference in long-term outcomes between depressed and nondepressed substance abusers in treatment, as well.

Furthermore, this atypical pattern is consistent with depressive symptoms such as increased rumination, affective responses, and cognitive distortions. There were even differences on the individual processes of change between the participants with and without elevated depressive symptoms consistent with features of depression. Before treatment, participants with elevated depressive symptoms struggled with rewarding themselves for behavior change (reinforcement management) and identifying relationships that will be supportive of their behavior change (helping relationships).

These behavioral processes of change require social interaction and a positive sense of self-worth, both of which are influenced negatively by depressive symptoms. This lower level of engagement is consistent with depression symptoms of anhedonia and hopelessness. Before initiating behavior change (pre-treatment), participants with elevated depressive symptoms struggled with engaging in the aspects of the change process that require a sense of self-worth and social engagement.

After treatment, the individual processes of change that the participants with elevated depressive symptoms used differently had a self-critical aspect when used *after* making a behavior change. These were experiential processes of change, which, as mentioned above, are typically used in initial stages of change. The participants with elevated depressive symptoms had a higher awareness of a need to change (consciousness raising), increased examination of the behavior and its impact on one's life (self-reevaluation), and an increased examination of the behavior and its impact on others (environmental reevaluation; Prochaska, Redding, & Evers, 2013). Tsoh and Hall (2004) also found that depressed adults attempting to quit smoking used self-reevaluation more than nondepressed adults. These tendencies in depressed adults after making a behavior change and maintaining that new behavior, are no longer necessary and focuses the participant on the past negative behavior rather than on the successful reduction of substance use and the work done to change that behavior.

Temptation Implicated in Unsuccessful Treatment Outcomes in Participants with Elevated Depressive Symptoms

When participants with elevated depressive symptoms were compared to each other on the basis of their success in treatment, temptation to use cocaine was much

higher in the least successful participants (i.e., those that used the cocaine the most at the end of treatment) compared to the most successful participants (i.e., those that abstained or used a small amount of cocaine at the end of treatment). This indicates that higher temptation is related to less successful treatment outcomes among participants with elevated depressive symptoms. Moreover, participants with elevated depressive symptoms as a whole were more tempted to use cocaine than nondepressed participants before and after treatment. This is consistent with depressive symptoms: emotional distress and negative affect are both a result of depression, and depression impairs self-regulation, all of which is implicated in reduced ability to resist temptation (Lovejoy & Heckman, 2014; Velasquez, Carbonari, & DiClemente, 1999).

These findings are also consistent with past research showing that lower temptation is implicated in more successful treatment outcomes among depressed substance abusers. Carbonari and DiClemente (2000) found that those who successfully reduced alcohol consumption after treatment had reduced endorsement of temptation in their TTM profile, while those who were not successful had higher levels of temptation at the end of treatment. Floyd et al. (2007), who were investigating the efficacy of a motivational interviewing intervention on women who were at risk for an alcohol exposed pregnancy, found that temptation for alcohol was a strong enough variable to be a confounder, so retained it in their final model. Tsoh and Hall (2004) found that non-treatment seeking depressed smokers were more tempted than the nondepressed smokers, especially in habitual and negative affect situations. In depressed adults with a substance use disorder, lower temptation is consistently implicated in successful reduction of substance use after treatment across studies.

Treatment Influenced Participants with Elevated Depressive Symptoms' Use of some TTM Constructs

Not only did participants with elevated depressive symptoms respond to treatment differently in their engagement with the processes of change as discussed earlier, but also with their engagement of some of the TTM constructs. These constructs include the experiential processes of change, behavioral processes of change, temptation, confidence, pros of change, cons of change, the precontemplation stage, the contemplation stage, and the action stage. While the participants with elevated depressive symptoms reduced substance use similarly to the nondepressed participants, they exhibited a different pattern of engaging with these variables than nondepressed participants, months after treatment. However, based on these constructs, there was no difference between how participants with elevated depressive symptoms who abstained or used less cocaine responded to treatment compared to those who used more cocaine. Therefore, treatment impacted participants with elevated depressive symptoms as a whole differently than nondepressed participants, but did not differentially impact the more successful and less successful participants with elevated depressive symptoms.

Pros of Change Similar between Participants with and without Elevated Depressive Symptoms

Past studies have had discrepant findings regarding the pros of change, that is the reasons people have to make a change (Tsoh & Hall, 2004; Velasquez, Carbonari, & DiClemente, 1999). In this study the pros of change were similar between participants with and without elevated depressive symptoms, which may be because these individuals were all seeking treatment so saw a need for change from the beginning of treatment. It

is also possible that the emotional toll of depression may not have substantially influenced the pros for change, as had been suggested earlier in this document. Furthermore, this may help explain why depressive symptoms are not an influencing factor for those who get "stuck" in the contemplation stage for long periods of time, as being in the contemplation stage involves maintaining an equal balance between the pros and cons for change (Prochaska & Velicer, 1997; Velicer, Prochaska, Fava, Norman, & Redding, 1998).

Overall, this study found that participants with elevated depressive symptoms were as successful as nondepressed participants in reducing their cocaine use after treatment, regardless of whether they were in the Education-Advice intervention or the TTM intervention. However, participants with elevated depressive symptoms engaged with the TTM variables differently compared to the nondepressed participants. This was especially notable with the processes of change and temptation variables. The behavioral processes of change were underutilized before treatment and the experiential processes of change were over-utilized after treatment, when they were no longer necessary to maintain abstinence. Temptation was endorsed in participants with elevated depressive symptoms who were less successful in reducing their cocaine use compared to those who were successful. In sum, the participants with elevated depressive symptoms endorsed TTM variables differently than the nondepressed participants, despite reducing their cocaine use as much as the nondepressed participants.

Limitations

A significant limitation of this study is in the generalizability of the sample. The demographics of this sample are not consistent with demographics of cocaine users

across the United States and therefore the results must be interpreted with caution. Specifically, there is a high proportion of male participants, black participants, and homeless participants in this sample. These findings may not apply to all people with a stimulant use disorder in the United States and especially may not be generalizable to high socio-economic status groups and cocaine users who seek residential treatment.

This study is also reliant on self-report measures, which have inherent bias. Self-report measures require introspective ability, which not all people have. Despite a desire to respond honestly, some may lack the awareness to be able to accurately respond. However, self-report measures also rely on the honesty of the participant. Social desirability bias drives responders to ascribe more positive traits to themselves and to generally reply in a way that makes them appear more favorable (Nederhof, 1985). Topics such as substance use and depression are particularly susceptible to social desirability bias (Furnham, 1986). Similarly, the designation of depression in this study was based on self-report measures, rather than a diagnostic interview. A diagnostic interview would provide a depression diagnosis, rather than an endorsement of depressive symptoms. Despite these drawbacks, self-report measures are a cost-effective way to gather large amounts of information from participants, as required in this study. A strength of this study, however, is that it took these biases into account and did a biochemical validation of cocaine use, which was found to be congruent with the self-reported cocaine use.

A further limitation to this study is the violation of the independence assumption inherent in group interventions (McCarthy, Whittaker, Boyle & Eyal, 2017). Participants in this study all received treatment in a group setting over the period of six weeks, which

resulted in unavoidable influence of group members on each other. While profile analysis and general linear model analysis of variance tests are robust to violations of assumptions, the participants nevertheless have shared variance due to their influence on each other in treatment groups over time.

As anxiety is highly associated with depressive symptoms, it may be a confounding variable in this study (Brown, Campbell, Lehman, Grisham, & Mancill, 2001). It is possible that anxiety accounts for some of the findings, rather than depressive symptoms. Furthermore, including anxiety in the analysis may make relationships with other variables apparent.

A strength of this study is that it includes follow-up data from three months after treatment. However, for dually diagnosed populations even more long-term data is valuable as dually diagnosed populations have negative long-term outcomes such as higher rates of substance use and mental health outcomes. More extended follow-up data could also evaluate for outcome differences over time by treatment group between the depressed and nondepressed participants.

Implications for Research

Despite noted limitations, this study was the first to examine individually the ten experiential and behavioral processes associated with the transtheoretical stages of change model to investigate the influence of depressive symptoms on treatment and behavior change. As each of the processes engages different components associated with depression, this investigation of the individual processes provided a more nuanced understanding of behavior change among cocaine users with elevated depressive symptoms. The finding that participants with elevated depressive symptoms engaged in

extended use of the experiential processes of change is especially compelling, and merits further study. This finding may have implications in various aspects of substance abuse treatment and wellness outcomes. Future studies should investigate if the extended use of experiential processes of change has any impact on reducing substance use, maintaining abstinence, quality of life, or depression symptoms. If the extended use of experiential processes of change in participants with elevated depressive symptoms is implicated in negative outcomes, then further research to examine how to reduce them following treatment is needed. It is possible that they would diminish after treating the depressive symptoms.

Future research should also consider whether temptation is an important treatment target for nondepressed substance abusers. In this study, temptation endorsement was low among the nondepressed participants. This indicates that it was not an important focus for treatment for the nondepressed participants, despite being related to treatment success for the participants with elevated depressive symptoms. It is possible that in past studies that found temptation to be a factor in treatment success, temptation mostly impacted the members of the sample with elevated depressive symptoms, rather than the sample as a whole. Future studies should take depressive symptoms into account, as it is possible that temptation would not be as relevant for the nondepressed adults.

Finally, participants with elevated depressive symptoms reduced substance use similarly to the nondepressed participants, but they exhibited a different pattern of engaging with the TTM variables than nondepressed participants. Future research should examine whether these profile differences are linked to more severe outcomes for adults with elevated depressive symptoms over time, such as increases in relapse or other

mental health outcomes. Overall, further research is needed to understand how adults with elevated depressive symptoms respond to substance abuse treatment and an increased understanding of their use of the TTM constructs appears to be promising.

Implications for Clinical Practice

As long-term outcomes for dually diagnosed adults are more severe than for those with substance use disorders only, modifications to treatment for this population would be of great benefit. This study sheds light on treatment for adults with substance use disorders and comorbid depression, as they responded to treatment differently on the constructs of the TTM compared to nondepressed participants. In early stages of change, treatment for dually diagnosed adults must address the underuse of behavioral processes of change. Later in the process of changing the behavior, the overuse of the experiential processes of change by depressed individuals must be considered and incorporated into treatment. Another treatment target for the dually diagnosed population implicated in this study is temptation, as reduced temptation is associated with improved outcomes in substance use in multiple studies, including this one.

These treatment targets can all be addressed in a group treatment setting, as well. Within group treatment, furthermore, consideration should be given to how groups are created. As dually diagnosed adults utilize the processes of change differently, creating groups for these individuals to target this atypical use would improve treatment outcomes (Velasquez, Gaddy Maurer, Crouch, & DiClemente, 2001). Group leaders should also be informed on the importance of targeting processes of change use and temptation in group members with depressive symptoms. Addressing these critical TTM constructs would

likely improve outcomes for dually diagnosed adults in group or individual treatment for substance abuse.

Conclusion

As dually diagnosed adults have worse health and use outcomes after substance abuse treatment, this study examined TTM constructs, looking to better understand this relationship. Using extant data from a feasibility study completed in 2006 by Dr. Mary Velasquez and colleagues on a TTM intervention for substance use, this study looked at the differences between adults with and without elevated depressive symptoms in treatment for cocaine abuse on the TTM constructs (i.e., temptation, confidence, pros of change, cons of change, the precontemplation stage of change, the contemplation stage of change, the action stage of change, the experiential processes of change, the behavioral processes of change, and each individual process of change).

This study found that dually diagnosed adults do engage with the TTM differently, especially with temptation and the processes of change. Individuals with elevated depressive symptoms experienced higher levels of experiential processes of change after treatment and higher levels of temptation throughout treatment. These findings were related to less successful treatment outcomes and may partly explain the difference in long-term outcomes between depressed and nondepressed substance abusers in treatment.

Future research in this area would allow for an increased understanding of the nuances of dually diagnosed individuals in treatment for substance abuse. One avenue of investigation is the impact that continued engagement with the experiential processes of change has on adults with elevated depressive symptoms in substance use change and

other mental health outcomes; if participants were followed for a longer period of time they might experience worse substance use or health outcomes. Another area of future research is to examine if the endorsement of TTM constructs changes when the depressive symptoms are treated. Examining behavior change in dually diagnosed adults through the TTM constructs has proven to be effective.

Clinical implications of these findings have the potential to reduce the more severe long-term outcomes experienced by dually diagnosed individuals. This study found that treatment for dually diagnosed adults must address the underuse of behavioral processes of change early in treatment, but in later treatment must address the overuse of the experiential processes of change. Additionally, temptation must be addressed throughout treatment as higher temptation has robust implications for worse outcomes.

Table 1

The Experiential and Behavioral Processes of Change

Experiential Processes *(generally used in early stages of change)*	
Consciousness Raising	Increasing awareness of the need to change and how to change
Self-Reevaluation	Reexamination of the behavior and how it affects his or her life
Social Liberation	Noticing how changes in society and environment make it easier to change the behavior; noting how the behavior is viewed by general society and how society encourages healthier options
Environmental Reevaluation	Reappraisal of the impact of the behavior on the environment or others
Dramatic Relief	The strong reaction of individuals who encounter warnings about their unhealthy behavior
Behavioral Processes *(generally used in later stages of change)*	
Stimulus Control	Making changes in one's environment to support behavior change
Counter Conditioning	Substituting new behaviors for the problematic behavior that one is working to change
Reinforcement Management	Rewarding oneself for not engaging in the target behavior
Helping Relationships	Identifying relationships in one's life that are supportive of the behavior change
Self-Liberation	The belief that one can change and committing to make a change

Note. Velasquez, Crouch, Stephens, & DiClemente, 2016; Velicer, Prochaska, Fava, Norman, & Redding, 1998.

Table 2

Sociodemographic Characteristics of Participants

Characteristics		All Clients	TTM Group	Ed-Advice
Race/Ethnicity				
	Latino	8.3%	7.8%	9.1%
	Black	72.2%	71.9%	72.7%
	White	19.4%	20.3%	18.2%
Gender				
	Female	24.4%	17.2%	25.0%
	Male	75.6%	82.8%	75.0%
Age (mean)				
		40.6	41.4	40.3
Education				
	<12 years	18.5%	25.0%	9.1%
	>12 years/ HS/GED	81.5%	75.0%	90.9%
Employment				
	Employed	40.2%	45.3%	32.6%
	Not Employed	52.3%	48.4%	58.1%
	Not in Workforce	7.5%	6.3%	9.3%
Income				
	<$5,000	36.1%	40.6%	29.5%
	$5,000-19,999	31.5%	29.8%	34.0%
	$20,000-29,000	15.7%	10.9%	22.7%
	$30,000+	16.7%	18.7%	13.8%
Homeless				
	Yes	38.9%	42.2%	34.1%

Note. TTM =transtheoretical model of change; Ed-Advice=Education/Advice (Control Group); HS=high school; GED=General Education Development test.

Table 3.

Drug Use and Treatment History of Participants

Category	All Clients
Cocaine	
Average Days Used in Past 30 Days	14.9
Average Years Used	14.2
Treatment History	
Previous Alcohol Treatment	23.1%
Previous Drug Treatment	63.4%
No Prior Treatment	33.6%
Cocaine Diagnosis	
Abuse	87.8%
Dependence	10.7%

Table 4

Descriptive Statistics of Depressive Symptoms Subscale and Global Severity Index of the Brief Symptom Inventory at Intake and Post-treatment

	Mean	Standard Deviation	Minimum	Maximum
Intake				
Depression Subscale	1.247	.894	0	3.83
Global Severity Index	1.016	.689	0	3.82
Post-treatment				
Depression Subscale	.969	1.761	0	16.50
Global Severity Index	.692	.696	0	2.62

Note. Scores derive from a Likert scale ranging from zero to four measuring how much symptoms created distress, where a zero indicates "not at all" and a four indicates "extremely."

Table 5

Mean and Standard Deviation of the Processes of Change at each Time Point for all Participants

	Intake		Post-Treatment		Follow-up	
	M	SD	M	SD	M	SD
Experiential Processes						
Consciousness Raising	3.691	.973	3.914	.819	3.892	1.025
Self-Reevaluation	3.953	.814	3.805	.826	3.742	1.025
Social Liberation (Experiential)	3.178	.990	3.484	.912	3.265	1.116
Environmental Reevaluation	3.765	.942	3.875	.769	3.729	1.040
Dramatic Relief	3.524	.860	3.474	.829	3.335	.948
Behavioral Processes						
Stimulus Control	3.044	.966	3.644	.971	3.596	1.118
Counter Conditioning	3.168	.865	3.620	.919	3.565	1.030
Reinforcement Management	2.896	.977	3.433	1.066	3.317	1.070
Helping Relationships	2.936	1.054	3.417	1.066	3.381	1.140
Self-Liberation	3.101	.944	3.660	.980	3.654	1.109
Social Liberation (Behavioral)	2.943	.963	3.346	.974	3.265	1.037

Note. Scores derive from a Likert scale measuring frequency of use ranging from one to five, where one indicates "never" and five indicates "repeatedly."

Table 6

Mean and Standard Deviation of the Transtheoretical Model Variables at each Time Point for all Participants

	Intake		Post-Treatment		Follow-up	
	M	SD	M	SD	M	SD
Experiential Processes	3.647	.674	3.750	.670	3.649	.858
Behavioral Processes	3.014	.696	3.520	.862	3.462	.949
Temptation	3.086	.838	2.558	.949	2.583	1.041
Confidence	2.668	.818	2.962	.994	3.130	1.081
Decisional Balance - Pros	3.615	1.087	3.662	1.069	3.723	1.126
Decisional Balance - Cons	2.105	.950	2.280	.961	2.311	1.088
Precontemplation	2.0331	.795	2.262	.853	2.091	.718
Contemplation	4.435	.578	4.018	.578	3.993	.845
Action	4.203	.568	3.908	.726	3.856	.868

Note. Scores derive from Likert scales ranging from one to five, where one indicates a lower level of endorsement and five indicates a higher level of endorsement.

Table 7

Mean and Standard Deviation of the Processes of Change of the Participants with and without Elevated Depressive Symptoms at each Time Point

	Intake		Post-Treatment		Follow-up	
	M	SD	M	SD	M	SD
Experiential Processes						
Consciousness Raising						
Depressed	3.780	.945	3.960	.703	4.123	.818
Not Depressed	3.662	.952	3.870	.895	3.700	1.110
Self-Reevaluation						
Depressed	3.968	.623	3.873	.806	4.100	.834
Not Depressed	3.836	.885	3.751	.846	3.514	1.083
Social Liberation (Experiential)						
Depressed	3.122	.829	3.508	.859	3.456	.840
Not Depressed	3.261	1.041	3.469	.957	3.197	1.233
Environmental Reevaluation						
Depressed	3.829	.934	4.016	.694	4.061	.782
Not Depressed	3.594	.972	3.763	.802	3.481	1.121
Dramatic Relief						
Depressed	3.537	.767	3.548	.782	3.531	.771
Not Depressed	3.401	.946	3.429	.828	3.240	1.044
Behavioral Processes						
Stimulus Control						
Depressed	3.106	.880	3.524	.952	3.684	1.040
Not Depressed	3.039	1.050	3.706	.977	3.495	1.173
Counter Conditioning						
Depressed	3.114	.791	3.492	.807	3.754	.899
Not Depressed	3.174	.870	3.686	.960	3.459	1.102
Reinforcement Management						
Depressed	2.675	1.029	3.143	1.090	3.211	1.061
Not Depressed	3.053	.930	3.655	.998	3.404	1.096
Helping Relationships						
Depressed	2.732	.970	3.333	1.136	3.303	1.082
Not Depressed	3.159	1.040	3.435	1.021	3.421	1.186
Self-Liberation						
Depressed	3.024	.944	3.611	.957	3.737	1.091
Not Depressed	3.106	.963	3.684	.980	3.552	1.125
Social Liberation (Behavioral)						
Depressed	2.951	.848	3.341	.900	3.254	.947
Not Depressed	2.952	.992	3.339	1.039	3.257	1.084

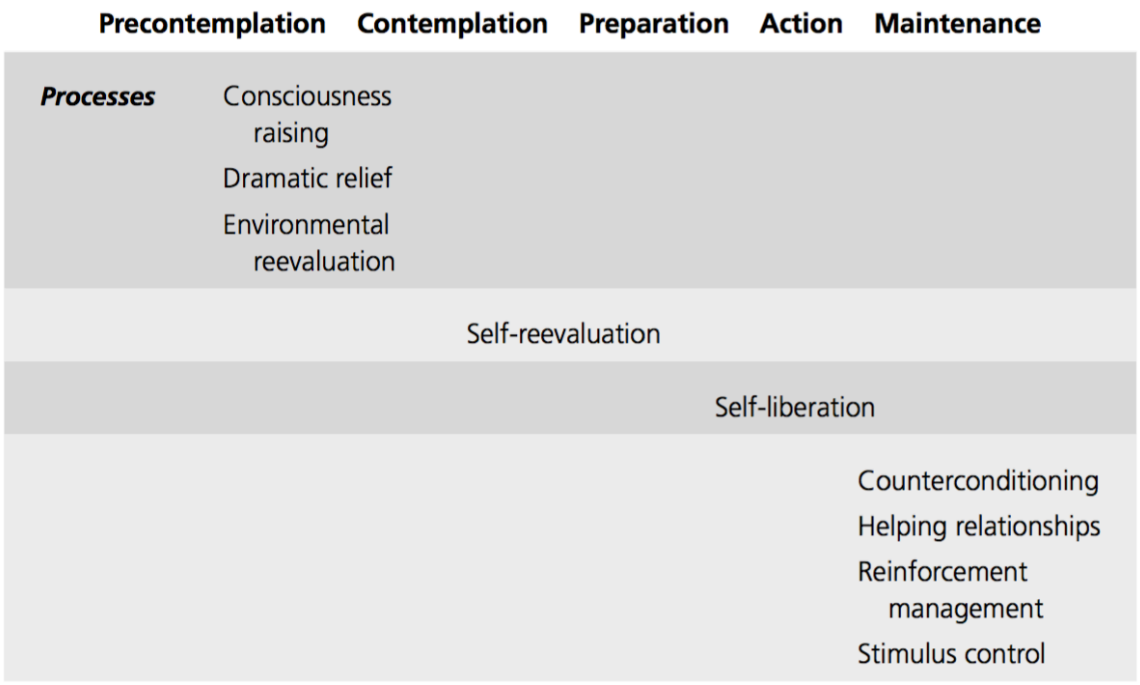
Note. Scores derive from a Likert scale measuring frequency of use ranging from one to five, where one indicates "never" and five indicates "repeatedly."

Table 8

Mean and Standard Deviation of the Transtheoretical Model Variables of Participants with and without Elevated Depressive Symptoms at each Time Point

	Intake		Post-Treatment		Follow-up	
	M	SD	M	SD	M	SD
Experiential Processes						
Depressed	3.696	.588	3.822	.589	3.904	.651
Not Depressed	3.570	.734	3.696	.713	3.478	.951
Behavioral Processes						
Depressed	2.932	.632	3.407	.819	3.489	.873
Not Depressed	3.081	.748	3.584	.885	3.431	1.017
Temptation						
Depressed	3.372	.730	2.834	.854	2.710	.909
Not Depressed	2.887	.838	2.370	.980	2.508	1.107
Confidence						
Depressed	2.641	.854	2.875	.900	3.134	1.029
Not Depressed	2.670	.836	3.009	1.072	3.196	1.097
Decisional Balance - Pros						
Depressed	3.532	1.101	3.611	.844	3.937	1.009
Not Depressed	3.630	1.059	3.683	1.232	3.612	1.181
Decisional Balance - Cons						
Depressed	2.091	.903	2.143	.778	2.320	1.083
Not Depressed	2.210	1.024	2.444	1.042	2.359	1.100
Precontemplation						
Depressed	2.143	.915	2.250	.817	2.082	.635
Not Depressed	2.036	.774	2.292	.876	2.140	.755
Contemplation						
Depressed	4.432	.455	4.120	.595	3.907	.840
Not Depressed	4.397	.608	3.932	.924	4.009	.857
Action						
Depressed	4.238	.527	3.932	.645	3.707	.920
Not Depressed	4.150	.595	3.874	.775	3.879	.831

Note. Scores derive from Likert scales ranging from one to five, where one indicates a lower level of endorsement and five indicates a higher level of endorsement.



Note: Social liberation was omitted due to its unclear relationship to the stages.

Figure 1. Processes of change that mediate progression between the stages of change according to the transtheoretical model of change (figure taken from Prochaska, Redding, & Evers, 2013).

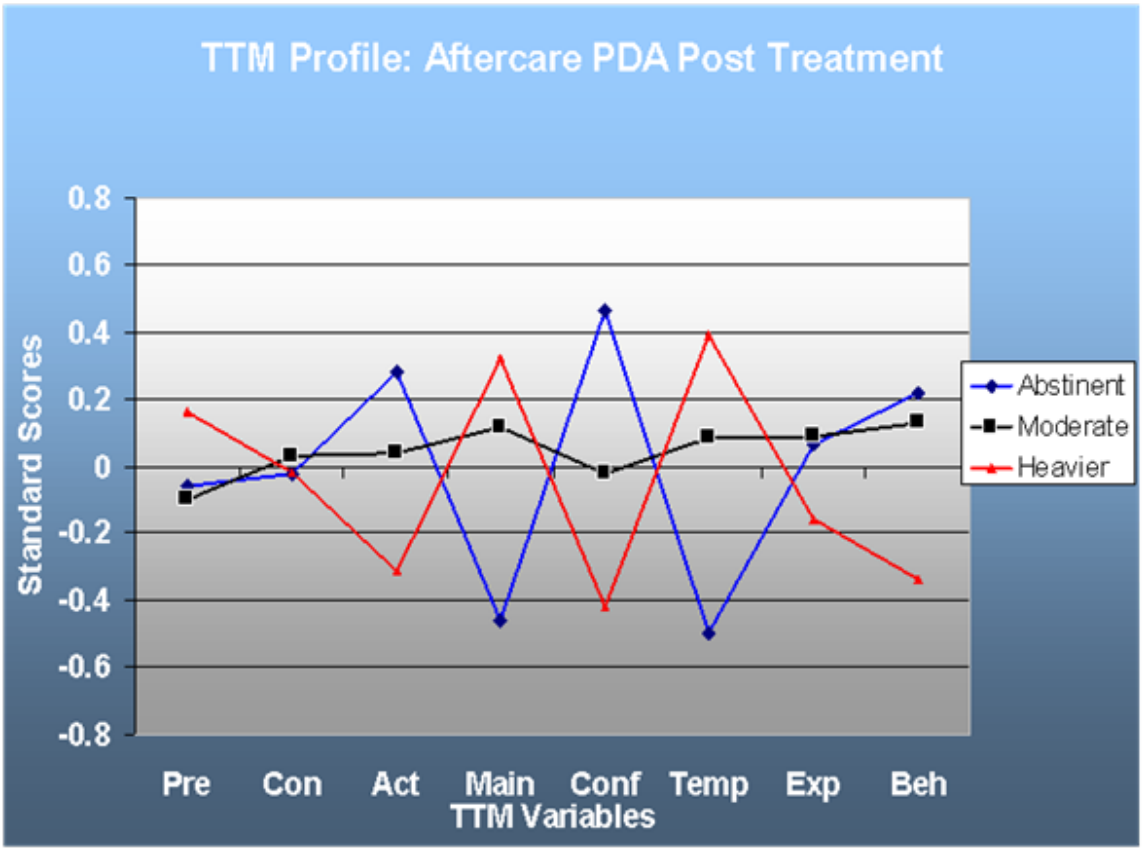


Figure 2. An example of profile analysis of drinking-outcome-related differences across transtheoretical model variables by Carbonari and DiClemente, 2000.

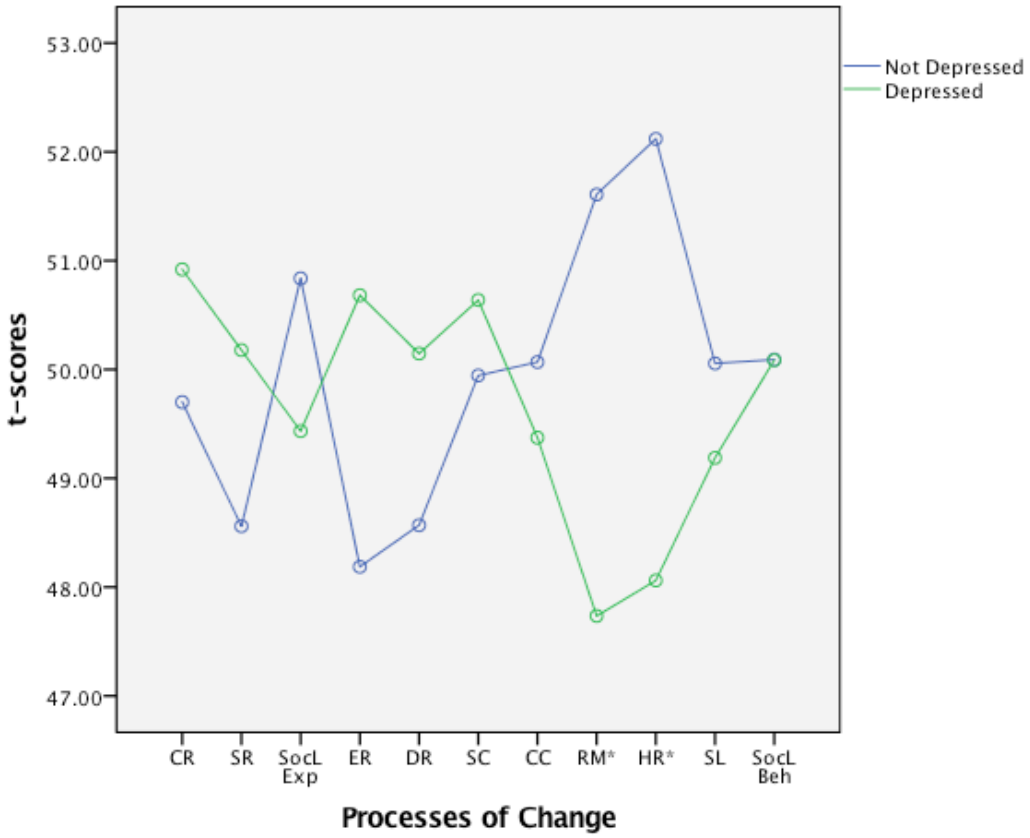


Figure 3. Processes of change of participants with and without elevated depressive symptoms at intake (profiles did not significantly deviate from parallelism at the .05 level). CR = consciousness raising; SR = self-reevaluation; SocL Exp = social liberation experiential; ER = environmental reevaluation; DR = dramatic relief; SC = stimulus control; CC = counter conditioning; RM = reinforcement management; HR = helping relationships; SL = self-liberation; SocL Beh = social liberation behavioral. *p < .05.

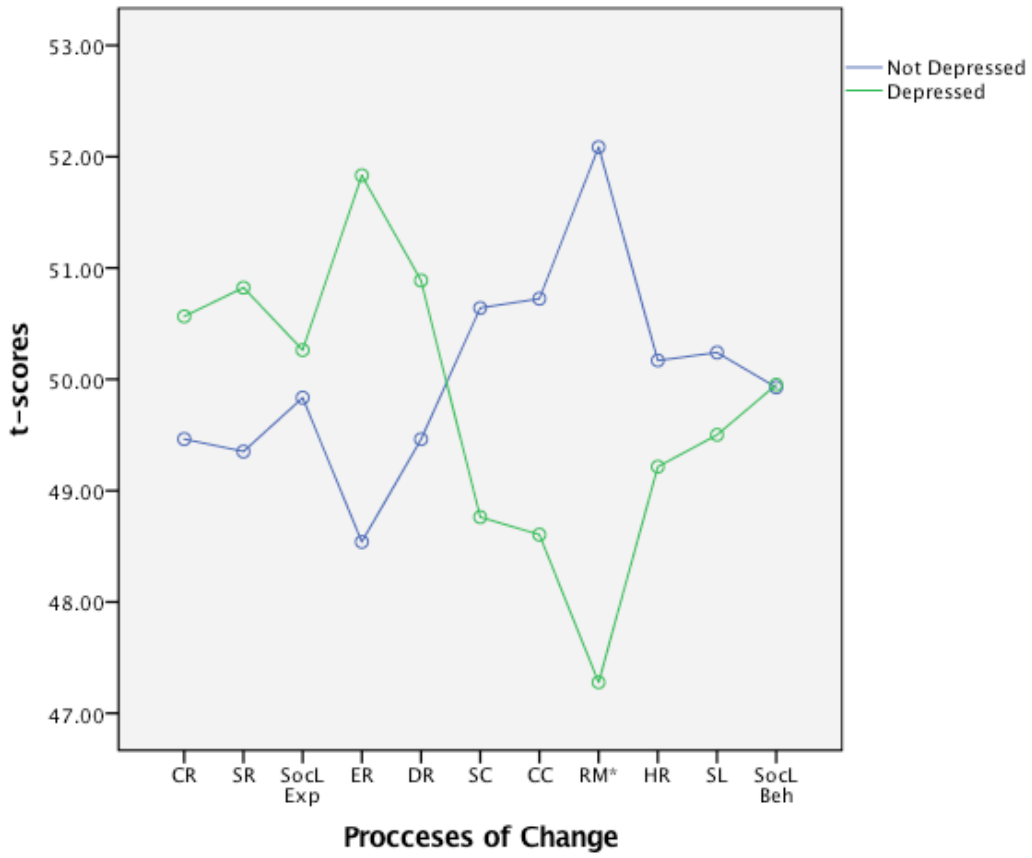


Figure 4. Processes of change of participants with and without elevated depressive symptoms at post-treatment (profiles did significantly deviate from parallelism at the .05 level). CR = consciousness raising; SR = self-reevaluation; SocL Exp = social liberation experiential; ER = environmental reevaluation; DR = dramatic relief; SC = stimulus control; CC = counter conditioning; RM = reinforcement management; HR = helping relationships; SL = self-liberation; SocL Beh = social liberation behavioral. *p < .05.

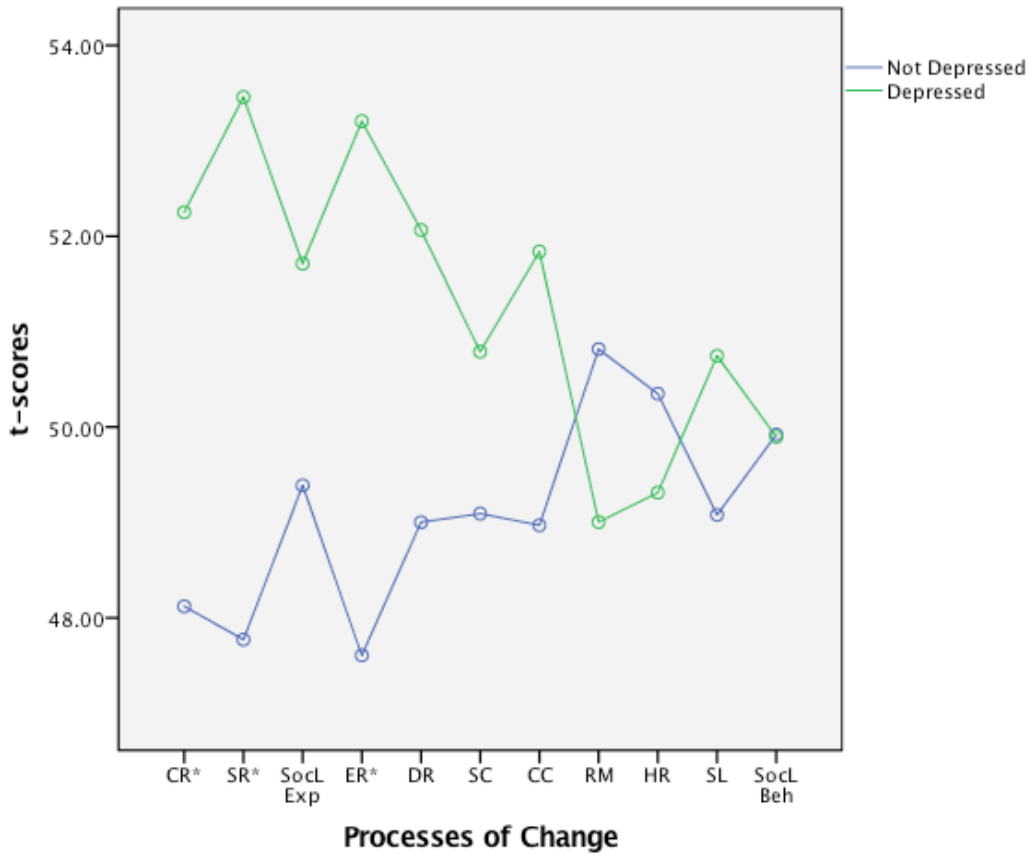


Figure 5. Processes of change of participants with and without elevated depressive symptoms at the three-month follow-up (profiles did significantly deviate from parallelism at the .05 level). CR = consciousness raising; SR = self-reevaluation; SocL Exp = social liberation experiential; ER = environmental reevaluation; DR = dramatic relief; SC = stimulus control; CC = counter conditioning; RM = reinforcement management; HR = helping relationships; SL = self-liberation; SocL Beh = social liberation behavioral. *p < .05.

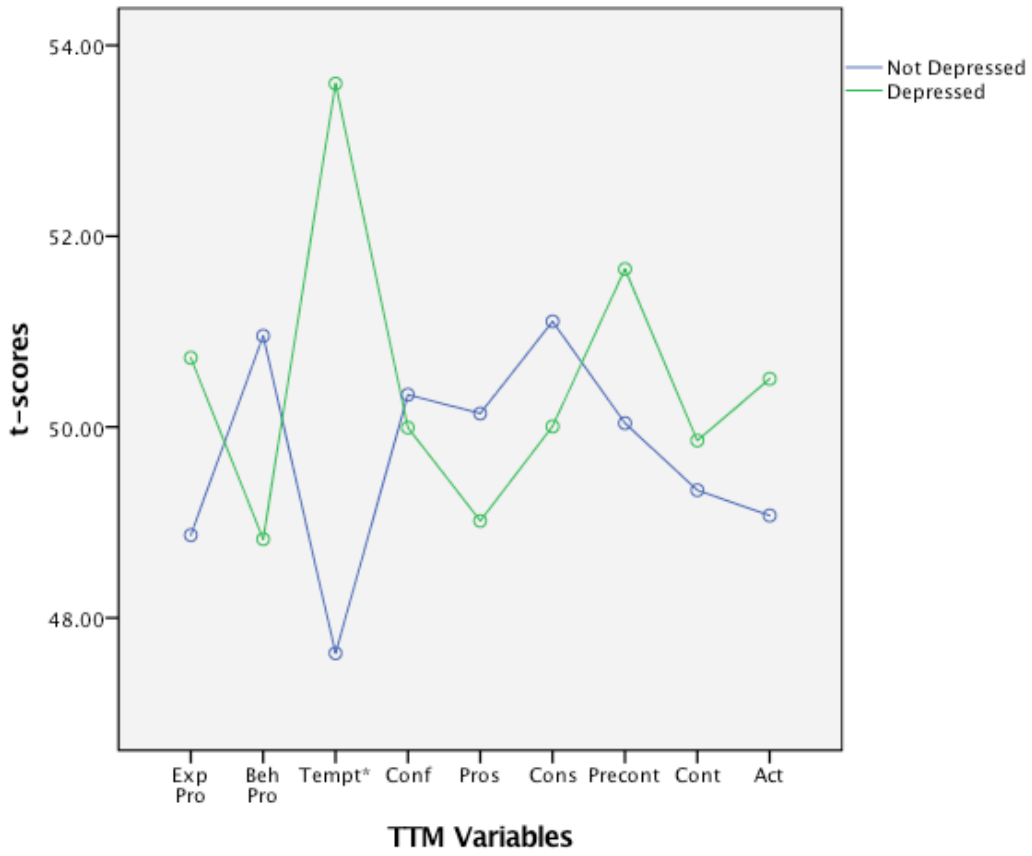


Figure 6. Transtheoretical model variables of participants with and without elevated depressive symptoms at intake (profiles did not significantly deviate from parallelism at the .05 level). Exp Pro = experiential processes; Beh Pro = behavioral processes; Tempt = temptation; Conf = confidence; Pros = pros of change; Cons = cons of change; Precont = precontemplation stage; Cont =contemplation stage; Act = action stage. *p < .05.

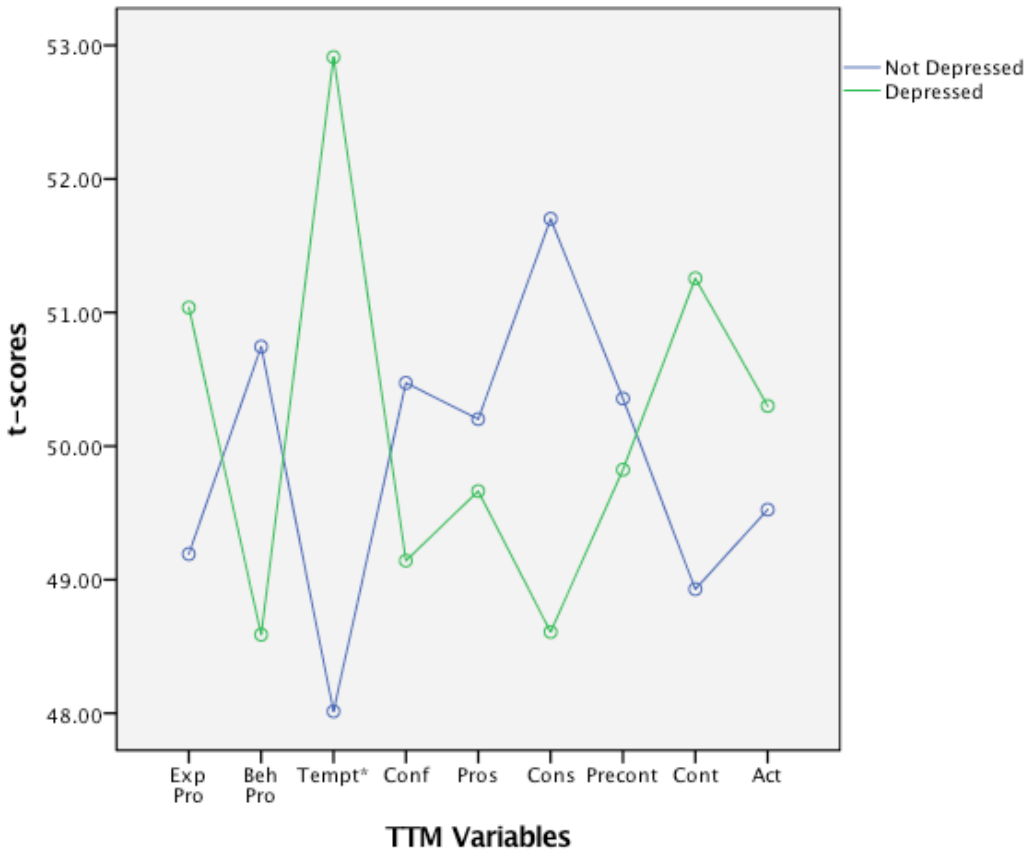


Figure 7. Transtheoretical model variables of participants with and without elevated depressive symptoms at post-treatment (profiles did not significantly deviate from parallelism at the .05 level). Exp Pro = experiential processes; Beh Pro = behavioral processes; Tempt = temptation; Conf = confidence; Pros = pros of change; Cons = cons of change; Precont = precontemplation stage; Cont =contemplation stage; Act = action stage. *$p < .05$.

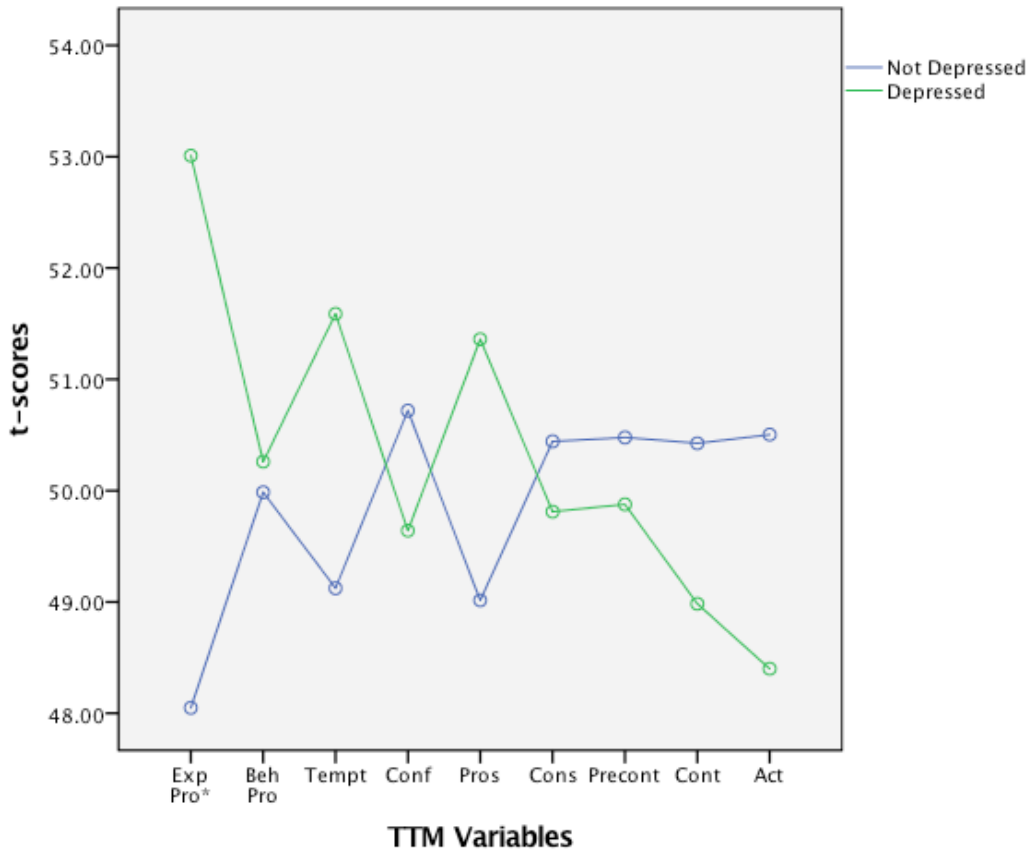


Figure 8. Transtheoretical model variables of participants with and without elevated depressive symptoms at three-month follow-up (profiles did significantly deviate from parallelism at the .05 level). Exp Pro = experiential processes; Beh Pro = behavioral processes; Tempt = temptation; Conf = confidence; Pros = pros of change; Cons = cons of change; Precont = precontemplation stage; Cont =contemplation stage; Act = action stage. *p < .05.

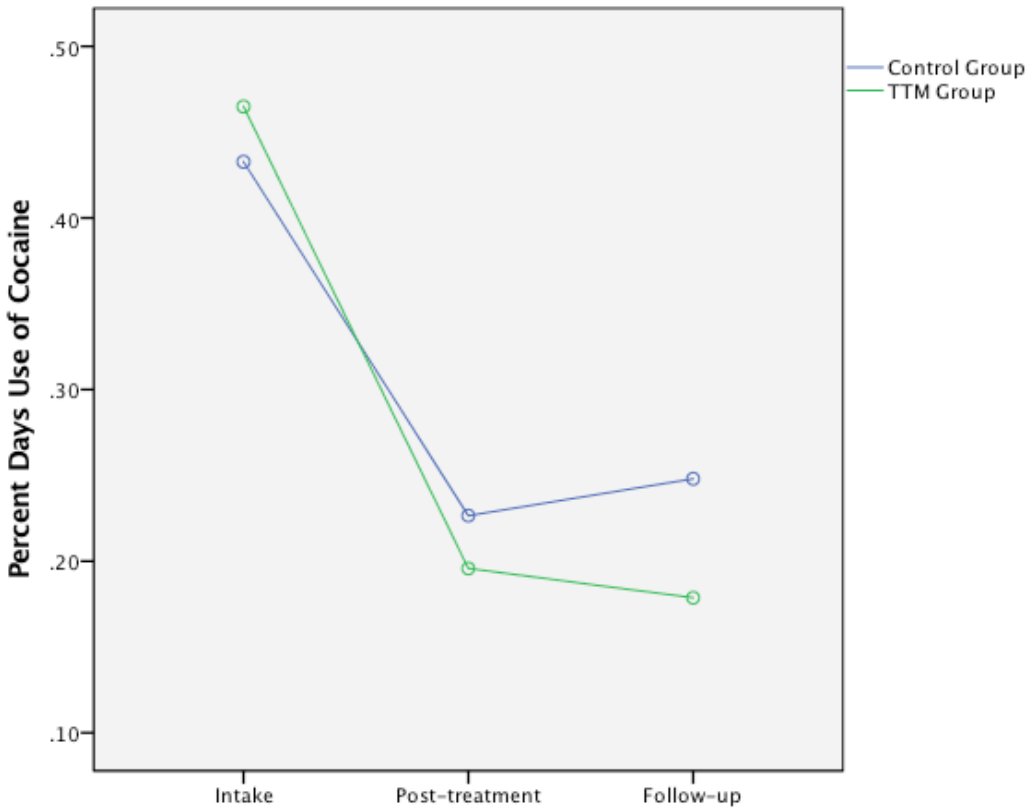


Figure 9. Percent daily use of cocaine at each time point by treatment condition. The time effect is significant at the .05 level but there is no difference between the TTM and control groups.

Appendix A

Methodology of Feasibility Study (Velasquez, Stotts, von Sternberg, Dodrill, & Sampson, not yet published)

Participants

The study was conducted at a university-based outpatient substance use disorders clinic. Recruitment methods included newspaper ads, radio ads, flyers, brochures and letters sent to professionals indicating that outpatient treatment was available. The intervention trial recruited and enrolled 138 participants and assigned them to the TTM intervention condition (n=82) or the Ed-Advice comparison condition (n=56)(see consort chart-Figure 1). We originally proposed four 12-session groups for each condition. However, given sufficient resources and our particular interest in the study aim "To assess the effect of the TTM group therapy on the proposed mechanisms of change," we ran two additional TTM groups for a total of 6 TTM groups and 4 Ed-Advice groups.

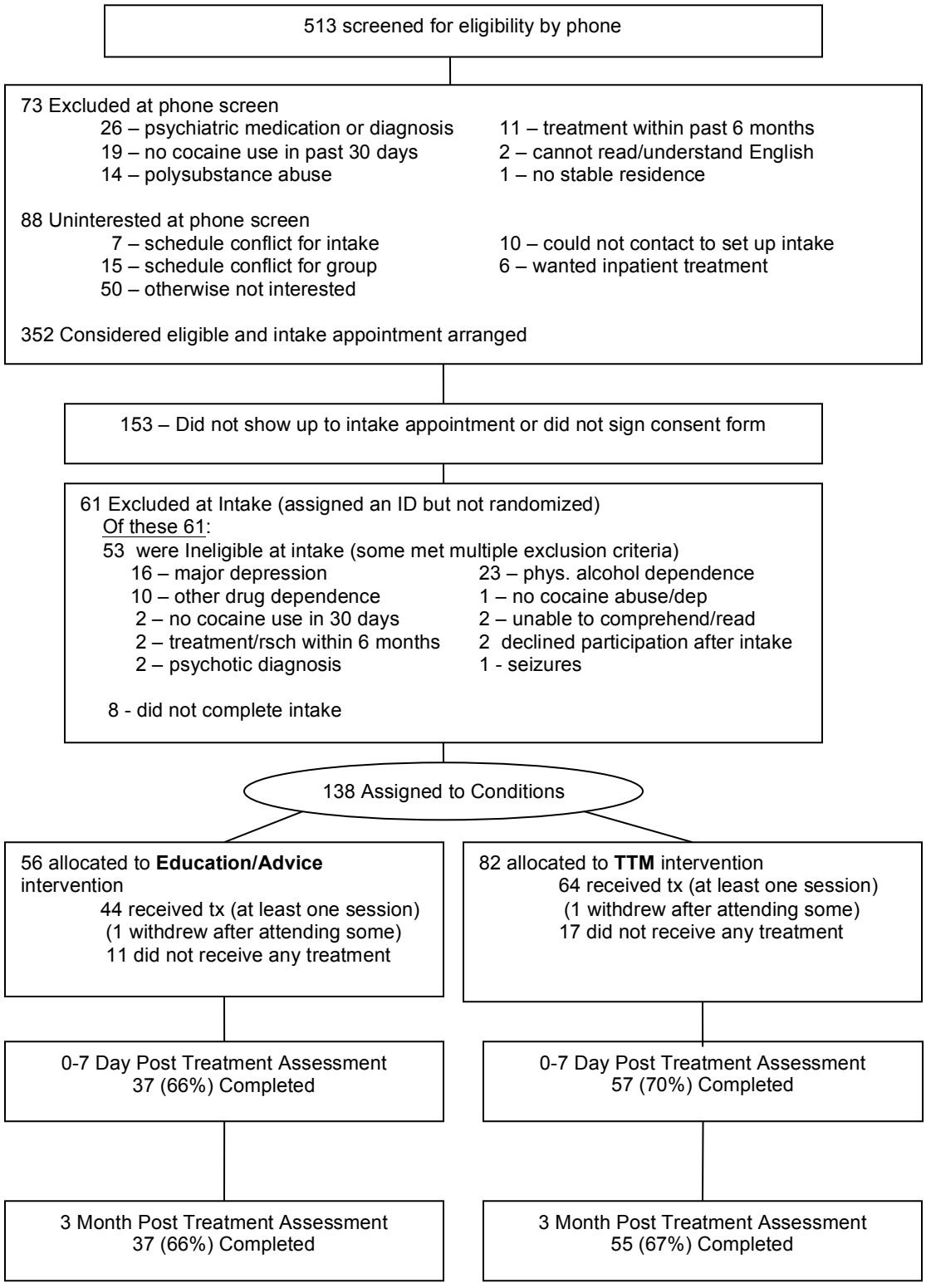
Eligible participants were over 18 and met DSM-IV criteria for cocaine abuse or dependence. Participants completed an intake assessment that included detailed information about the study, demographic information, personal history and degree of cocaine and other substance use. Each intake cohort was assigned together to the next available group within 33 days of their completed intake (on average, group began 13 days after participant intake).

Design and Procedure

The primary aims were 1) to modify the Group Treatment for Substance Abuse: A Stages-of-Change Therapy Manual to specifically target cocaine abuse, resulting in a twelve-session, group intervention and accompanying therapy manual based on the TTM stages and processes of change, 2) to develop the parallel training program and training materials for therapists, and 3) to train therapists to deliver the intervention. The stage 1b primary aim was to conduct a preliminary trial with cocaine abusing participants comparing the TTM group therapy to an education/advice comparison group. This pilot study was designed to a) demonstrate the feasibility of delivering the TTM group therapy with masters-level mental health professionals; b) determine acceptance of the TTM group therapy as measured by client adherence, retention, and treatment satisfaction; c) assess participant improvement over the course of treatment (e.g., drug use). Additional aims of stage 1b were to assess the effect of the TTM group therapy on the proposed mechanisms of change, thereby testing whether a) TTM group therapy increases processes of change use compared to the comparison group; b) increased process use promotes stage of change movement; and c) process use and stage movement enhance retention and diminish drug use. Finally, we proposed to measure motivation (i.e., stage of change) and determine whether there is differential outcome for those in early vs. late stages of change thus providing valuable information regarding matching (and mis-matching) motivation with treatment.

The study successfully accomplished all phases of the originally proposed research. First, a TTM intervention manual was created specifically for the study population by modifying the existing *Group Treatment for Substance Abuse: A Stages-of-Change Therapy Manual* by

Figure 1: Consort Chart



Velasquez et al. (2001) into a 12-session group therapy intervention for cocaine use. Development of the cocaine-specific 12 session manual was informed by focus groups of recovering cocaine users and an advisory panel composed of researchers and clinicians with vast experience working with the TTM and cocaine abusing clients. The

advisory panel reviewed the modifications of the original treatment manual with special attention to feedback from the focus groups. The result was a 12 session (six experiential POC sessions and six behavioral POC sessions) cocaine group treatment. The reduced number of sessions allowed us to offer a relatively brief yet comprehensive intervention that targets each of the TTM processes of change.

Both the TTM groups and the Ed-Advice groups were closed groups that met twice a week for six weeks for a total of twelve 90-minute sessions. Each week, participants provided a urine sample and completed scheduled measures. Participants received a small stipend ($10) for each session they attended. All sessions were videotaped. After each session, therapists wrote a session summary and completed a Therapist Treatment Evaluation form which described their perceptions of participant involvement/satisfaction. They also completed a session feedback form (Therapist Feedback) about the session activities, and a session checklist, which served as a measure of therapist competence and treatment adherence. All videotapes were reviewed by Drs. Velasquez or Stotts to assure treatment fidelity. All therapists received weekly supervision throughout.

Measures administered in the study gathered information about demographics, diagnoses, participant substance use, psychiatric status, and psychosocial functioning. TTM measures assessed experiential and behavioral POC, readiness for change, temptation, confidence, and decisional balance. Clients and therapists also completed measures on treatment satisfaction, adherence, therapeutic alliance, and group cohesion. some measures were administered at each session, some each week and others at intake, mid-treatment, end-of-treatment and at 3 months post-treatment

Study Conditions

The TTM groups followed the adapted treatment manual intervention. The first six sessions focused on the experiential POC and the last six addressed the behavioral POC. The TTM groups were co-facilitated by two experienced therapists. Four master's and doctoral-level therapists served as co-facilitators over the course of the study. The same clinicians conducted each of the twelve sessions for each cohort. Prior to leading the groups, all therapists thoroughly reviewed the manual and met twice with the PI and other research team members for implementation training. Training included detailed instruction on the intervention and treatment protocol, training in TTM with an emphasis on the POC, role plays and practice.

The Ed-Advice group followed a manualized intervention focused on traditional outpatient treatment strategies to build skills for successfully reducing cocaine use. This intervention utilized educational materials that are typically used in traditional substance abuse treatment. Sessions included both didactic and discussion components in which clients were introduced to the materials and then discussed how the information applied to their cocaine use. Clients were encouraged to attend twelve-step meetings but these meetings were not discussed in depth during group sessions. Session content included: an introduction to the biopsychosocial model of addiction and symptoms associated with cocaine use; defense mechanisms; social support; effects of cocaine on the brain; the disease model; negative consequences; stages of recovery; nutrition; codependency; HIV and cocaine abuse; and job finding strategies.

The Ed-Advice group was delivered by experienced masters and doctoral level therapists over 12 sessions. Similar to training for the TTM condition, prior to leading the groups all therapists thoroughly reviewed the manual and met twice with the PI and other research team members for training. Training included instructions on delivering the material in a didactic style and on allowing discussion of the materials. The PI provided weekly supervision to the therapists.

In sum, the primary aims of a stage I pilot study were to determine the feasibility, acceptance and promise of a newly-developed behavioral intervention. Consistent with the specific aims of our original study, we modified the newly-developed treatment manual to specifically target cocaine abuse, developed the parallel training program and materials for therapists, and trained master's and doctoral level therapists to deliver the intervention. As detailed below, we then conducted a pilot study which demonstrated the feasibility of delivery of the manualized intervention, determined acceptance of the TTM group therapy and assessed participant improvement over the course of treatment. We further assessed the effect of the intervention on process use and cocaine use and examined these in relation to participants' readiness to change.

Appendix B

BRIEF SYMPTOM INVENTORY

There are five possible responses to each of the items in this questionnaire:

0 - Not at all
1 - A little bit
2 - Moderately
3 - Quite a bit
4 - Extremely

Please circle the number that indicates how much you are currently (last 7 days) distressed by each of the following:

		Not at all	**A little bit**	**Moderately**	**Quite a bit**	**Extremely**
1.	Nervousness or shakiness inside	0	1	2	3	4
2.	Faintness or dizziness	0	1	2	3	4
3.	The idea that someone else can control your thoughts	0	1	2	3	4
4.	Feeling others are to blame for most of your troubles	0	1	2	3	4
5.	Trouble remembering things	0	1	2	3	4
6.	Feeling easily annoyed or irritated	0	1	2	3	4
7.	Pains in heart or chest	0	1	2	3	4
8.	Feeling afraid in open spaces or on the streets	0	1	2	3	4
9.	Thoughts of ending your life	0	1	2	3	4
10.	Feeling that most people cannot be trusted	0	1	2	3	4
11.	Poor appetite	0	1	2	3	4

		Not at all	A little bit	Moderately	Quite a bit	Extremely
12.	Suddenly scared for no reason	0	1	2	3	4
13.	Temper outbursts that you could not control	0	1	2	3	4
14.	Feeling lonely even when you are with people	0	1	2	3	4
15.	Feeling blocked in getting things done	0	1	2	3	4
16.	Feeling lonely	0	1	2	3	4
17.	Feeling blue	0	1	2	3	4
18.	Feeling no interest in things	0	1	2	3	4
19.	Feeling fearful	0	1	2	3	4
20.	Your feelings being easily hurt	0	1	2	3	4
21.	Feeling that people are unfriendly or dislike you	0	1	2	3	4
22.	Feeling inferior to others	0	1	2	3	4
23.	Nausea or upset stomach	0	1	2	3	4
24.	Feeling that you are watched or talked about by others	0	1	2	3	4
25.	Trouble falling asleep	0	1	2	3	4
26.	Having to check and double-check what you do	0	1	2	3	4
27.	Difficulty making decisions	0	1	2	3	4
28.	Feeling afraid to travel on buses, subways, or trains	0	1	2	3	4

		Not at all	A little bit	Moderately	Quite a bit	Extremely
			1	2	3	4
29.	Trouble getting your breath	0				
30.	Hot or cold spells	0	1	2	3	4
31.	Having to avoid certain things, places or activities because they frighten you	0	1	2	3	4
32.	Your mind going blank	0	1	2	3	4
33.	Numbness or tingling in parts of your body	0	1	2	3	4
34.	The idea that you should be punished for your sins	0	1	2	3	4
35.	Feeling hopeless about the future	0	1	2	3	4
36.	Trouble concentrating	0	1	2	3	4
37.	Feeling weak in parts of your body	0	1	2	3	4
38.	Feeling tense or keyed up	0	1	2	3	4
39.	Thoughts of death or dying	0	1	2	3	4
40.	Having urges to beat, injure, or harm someone	0	1	2	3	4
41.	Having urges to break or smash things	0	1	2	3	4
42.	Feeling very self-conscious with others	0	1	2	3	4
43.	Feeling uneasy in crowds, such as shopping or at a movie	0	1	2	3	4
44.	Never feeling close to another person	0	1	2	3	4

		Not at all	A little bit	Moderately	Quite a bit	Extremely
45.	Spells of terror or panic	0	1	2	3	4
46.	Getting into frequent arguments	0	1	2	3	4
47.	Feeling nervous when you are left alone	0	1	2	3	4
48.	Others not giving you proper credit for your achievements	0	1	2	3	4
49.	Feeling so restless you couldn't sit still	0	1	2	3	4
50.	Feelings of worthlessness	0	1	2	3	4
51.	Feeling that people will take advantage of you if you let them	0	1	2	3	4
52.	Feelings of guilt	0	1	2	3	4
53.	The idea that something is wrong with your mind	0	1	2	3	4

Appendix C

PROCESSES OF CHANGE

This questionnaire is designed to give us a better understanding of what strategies you have used to help yourself to not use cocaine. Each statement describes a situation or thought that a person might try to help them not use cocaine. Please indicate how often you experience or do any of the following to help you avoid using cocaine.

1. I realize that when I am using cocaine I am not the person I want to be.
    1. Never
    2. Seldom
    3. Occasionally
    4. Frequently
    5. Repeatedly

2. I stop to think about how my cocaine use has affected my family, work and social life.
    1. Never
    2. Seldom
    3. Occasionally
    4. Frequently
    5. Repeatedly

3. Keeping myself busy reduces my craving for cocaine.
    1. Never
    2. Seldom
    3. Occasionally
    4. Frequently
    5. Repeatedly

4. I avoid people I've used cocaine with.
    1. Never
    2. Seldom
    3. Occasionally
    4. Frequently
    5. Repeatedly

5. When tempted to use cocaine, I try to distract myself by doing something else.
    1. Never
    2. Seldom
    3. Occasionally
    4. Frequently
    5. Repeatedly

6. I have someone who listens when I need to talk about my cocaine use.
    1. Never
    2. Seldom
    3. Occasionally
    4. Frequently
    5. Repeatedly

7. I see advertisements or hear reports about how society wants people to be drug free.
    1. Never
    2. Seldom
    3. Occasionally
    4. Frequently
    5. Repeatedly

8. I find ways to reward myself for not using cocaine.
    1. Never
    2. Seldom
    3. Occasionally
    4. Frequently
    5. Repeatedly

9. I am ashamed of some of the things I've done while using cocaine.
    1. Never
    2. Seldom
    3. Occasionally
    4. Frequently
    5. Repeatedly

10. There is someone in my life who tries to make me feel good for staying off cocaine.
    1. Never
    2. Seldom
    3. Occasionally
    4. Frequently
    5. Repeatedly

11. I seek out places to get help when I need it.
    1. Never
    2. Seldom
    3. Occasionally
    4. Frequently
    5. Repeatedly

12. I have strong feelings about how much my cocaine use has hurt the people I care about.

1. Never
2. Seldom
3. Occasionally
4. Frequently
5. Repeatedly

13. I see signs in public places that tell people not to use drugs like cocaine.
    1. Never
    2. Seldom
    3. Occasionally
    4. Frequently
    5. Repeatedly

14. I have learned that cocaine may cause serious emotional problems.
    1. Never
    2. Seldom
    3. Occasionally
    4. Frequently
    5. Repeatedly

15. I stop and think that my cocaine use is causing problems for other people.
    1. Never
    2. Seldom
    3. Occasionally
    4. Frequently
    5. Repeatedly

16. I am disappointed in myself when I turn to cocaine.
    1. Never
    2. Seldom
    3. Occasionally
    4. Frequently
    5. Repeatedly

17. It frightens me when I think of situations I have found myself in because of cocaine.
    1. Never
    2. Seldom
    3. Occasionally
    4. Frequently
    5. Repeatedly

18. It helps me to do something physically active to keep from using cocaine.
    1. Never

2. Seldom
3. Occasionally
4. Frequently
5. Repeatedly

19. I avoid places where people are using cocaine.
    1. Never
    2. Seldom
    3. Occasionally
    4. Frequently
    5. Repeatedly

20. I look for people who will support and care about me in my attempts to change.
    1. Never
    2. Seldom
    3. Occasionally
    4. Frequently
    5. Repeatedly

21. I do something nice for myself when I don't give in to my urge to use cocaine.
    1. Never
    2. Seldom
    3. Occasionally
    4. Frequently
    5. Repeatedly

22. I have become more aware of the dangers of using cocaine.
    1. Never
    2. Seldom
    3. Occasionally
    4. Frequently
    5. Repeatedly

23. I make commitments to myself to stay away from cocaine.
    1. Never
    2. Seldom
    3. Occasionally
    4. Frequently
    5. Repeatedly

24. The strength of my cravings for cocaine frightens me.
    1. Never
    2. Seldom

3. Occasionally
4. Frequently
5. Repeatedly

25. I look for resources in the community that can help me avoid using cocaine.
    1. Never
    2. Seldom
    3. Occasionally
    4. Frequently
    5. Repeatedly
26. I set goals for myself to stay off cocaine no matter how hard it is.
    1. Never
    2. Seldom
    3. Occasionally
    4. Frequently
    5. Repeatedly

27. Stories about the dangers of cocaine affect me emotionally.
    1. Never
    2. Seldom
    3. Occasionally
    4. Frequently
    5. Repeatedly

28. I stay away from things (triggers) associated with my cocaine use.
    1. Never
    2. Seldom
    3. Occasionally
    4. Frequently
    5. Repeatedly

29. I notice more people saying they don't want to be pressured to use cocaine anymore.
    1. Never
    2. Seldom
    3. Occasionally
    4. Frequently
    5. Repeatedly

30. I have come to understand that serious medical problems may result from cocaine use.
    1. Never
    2. Seldom
    3. Occasionally

4. Frequently
5. Repeatedly

31. I act on my plan to stay cocaine free.
    1. Never
    2. Seldom
    3. Occasionally
    4. Frequently
    5. Repeatedly

32. I have someone I can count on when I'm having cocaine-related problems.
    1. Never
    2. Seldom
    3. Occasionally
    4. Frequently
    5. Repeatedly

33. I am focusing on the areas of my life that I have neglected because of my cocaine use.
    1. Never
    2. Seldom
    3. Occasionally
    4. Frequently
    5. Repeatedly

Appendix D

Cocaine Abstinence Self-Efficacy Temptation

Listed below are a number of situations that lead some people to use cocaine. We would like to know how tempted you would be to use cocaine in each of these situations.

Choose the response that best describes the feelings of temptation you have for each situation, at the present time, according to the following scale:

1 Not at all tempted
2 Not very tempted
3 Moderately tempted
4 Very tempted
5 Extremely tempted

Again we want to know how tempted you are at the present time, that you would use cocaine on each of these situations.

Situation	How Tempted				
1. When I am craving cocaine.	1	2	3	4	5
2. When my body is aching.	1	2	3	4	5
3. When I am feeling depressed.	1	2	3	4	5
4. When I want to relax.	1	2	3	4	5
5. When someone disappoints me or lets me down.	1	2	3	4	5
6. When I am very worried.	1	2	3	4	5
7. When I have the urge to try one hit of cocaine to see what happens.	1	2	3	4	5
8. When someone offers me cocaine.	1	2	3	4	5
9. When I dream about taking a hit of cocaine.	1	2	3	4	5
10. When I want to test my will power over using cocaine.	1	2	3	4	5
11. When I am feeling a physical need or craving for cocaine.	1	2	3	4	5

12. When I am physically tired.	1	2	3	4	5
13. When I feel some physical pain or injury.	1	2	3	4	5
14. When I feel like blowing up because of frustration.	1	2	3	4	5
15. When I see others using or buying cocaine.	1	2	3	4	5
16. When I sense that everything is going wrong for me.	1	2	3	4	5
17. When people I used to use cocaine with encourage me to use cocaine.	1	2	3	4	5
18. When I am feeling angry inside.	1	2	3	4	5
19. When I have an urge to use cocaine that catches me unprepared.	1	2	3	4	5
20. When I am excited or celebrating with others.	1	2	3	4	5
21. When I think about the last time I got high.	1	2	3	4	5
22. When someone hurts my feelings.	1	2	3	4	5
23. When I think about my first hit of cocaine.	1	2	3	4	5
24. When I get money.	1	2	3	4	5
25. When I see someone I used to use cocaine with.	1	2	3	4	5
26. When I'm feeling bored.	1	2	3	4	5
27. When I pass by the neighborhood that I used cocaine in.	1	2	3	4	5
28. After I've had enough alcohol.	1	2	3	4	5
29. When I'm feeling lonely.	1	2	3	4	5
30. When it's the weekend.	1	2	3	4	5
31. When I want to lose weight.	1	2	3	4	5

Cocaine Abstinence
Self-Efficacy
Confidence

Listed below are a number of situations that lead some people to use cocaine. We would like to know how confident you are that you would NOT use cocaine in each of these situations.

Choose the response that best describes the feelings of confidence you have for each situation, at the present time, according to the following scale:

1 Not at all confident
2 Not very confident
3 Moderately confident
4 Very confident
5 Extremely confident

Again we want to know how confident you are at the present time, that you would NOT use cocaine on each of these situations.

Situation	How Confident				
1. When I am craving cocaine.	1	2	3	4	5
2. When my body is aching.	1	2	3	4	5
3. When I am feeling depressed.	1	2	3	4	5
4. When I want to relax.	1	2	3	4	5
5. When someone disappoints me or lets me down.	1	2	3	4	5
6. When I am very worried.	1	2	3	4	5
7. When I have the urge to try one hit of cocaine to see what happens.	1	2	3	4	5
8. When someone offers me cocaine.	1	2	3	4	5
9. When I dream about taking a hit of cocaine.	1	2	3	4	5
10. When I want to test my will power over using cocaine.	1	2	3	4	5
11. When I am feeling a physical need or craving for cocaine.	1	2	3	4	5
12. When I am physically tired.	1	2	3	4	5

13. When I feel some physical pain or injury.	1	2	3	4	5
14. When I feel like blowing up because of frustration.	1	2	3	4	5
15. When I see other using or buying cocaine.	1	2	3	4	5
16. When I sense that everything is going wrong for me.	1	2	3	4	5
17. When people I used to use cocaine with encourage me to use cocaine.	1	2	3	4	5
18. When I am feeling angry inside.	1	2	3	4	5
19. When I have an urge to use cocaine that catches me unprepared.	1	2	3	4	5
20. When I am excited or celebrating with others.	1	2	3	4	5
21. When I think about the last time I got high.	1	2	3	4	5
22. When someone hurts my feelings.	1	2	3	4	5
23. When I think about my first hit of cocaine.	1	2	3	4	5
24. When I get money.	1	2	3	4	5
25. When I see someone I used to use cocaine with.	1	2	3	4	5
26. When I'm feeling bored.	1	2	3	4	5
27. When I pass by the neighborhood that I used cocaine in.	1	2	3	4	5
28. After I've had enough alcohol.	1	2	3	4	5
29. When I'm feeling lonely.	1	2	3	4	5
30. When it's the weekend.	1	2	3	4	5
31. When I want to lose weight.	1	2	3	4	5

Appendix E

Decisional Balance

PROS AND CONS: The following statements represent different opinions about cocaine. Please rate HOW IMPORTANT each statement is to you in deciding whether or not to use cocaine according to the following 5 point scale with 1 = Extremely important and 5 = Not important.

1. I feel better about my self while using cocaine.
    1. Extremely important
    2. Quite important
    3. Somewhat important
    4. A little bit important
    5. Not important

2. Cocaine makes me feel more confident and sociable.
    1. Extremely important
    2. Quite important
    3. Somewhat important
    4. A little bit important
    5. Not important

3. I am more fun to be with when I use cocaine.
    1. Extremely important
    2. Quite important
    3. Somewhat important
    4. A little bit important
    5. Not important

4. My cocaine use has led me to act irresponsibly.
    1. Extremely important
    2. Quite important
    3. Somewhat important
    4. A little bit important
    5. Not important

5. I feel more confident when I use cocaine.
    1. Extremely important
    2. Quite important
    3. Somewhat important
    4. A little bit important
    5. Not important

6. When using cocaine I fail to keep up with bills.
    1. Extremely important

2. Quite important
3. Somewhat important
4. A little bit important
5. Not important

7. Cocaine helps me relieve tension.
    1. Extremely important
    2. Quite important
    3. Somewhat important
    4. A little bit important
    5. Not important

8. As I became more involved with cocaine, I pulled away from people I was once close to.
    1. Extremely important
    2. Quite important
    3. Somewhat important
    4. A little bit important
    5. Not important

9. When using cocaine, I borrow money, which I fail to pay back.
    1. Extremely important
    2. Quite important
    3. Somewhat important
    4. A little bit important
    5. Not important

10. Cocaine gives me that extra boost of energy.
    1. Extremely important
    2. Quite important
    3. Somewhat important
    4. A little bit important
    5. Not important

11. Buying cocaine has contributed to my experiencing some financial strain.
    1. Extremely important
    2. Quite important
    3. Somewhat important
    4. A little bit important
    5. Not important

12. I experience sleep problems when I use cocaine.
    1. Extremely important
    2. Quite important

3. Somewhat important
4. A little bit important
5. Not important

Appendix F

University of Rhode Island Change Assessment

Follow-Up Version (URICA-F)

Each statement below describes how a person might feel when approaching problems related to cocaine use in their lives. Please indicate the extent to which you tend to agree or disagree with each statement. In each case, make your choice in terms of how you feel **RIGHT NOW**, not what you have felt in the past or would like to feel.

There are FIVE possible responses to each of the items in the questionnaire:

1 = Strongly Disagree
2 = Disagree
3 = Undecided
4 = Agree
5 = Strongly Agree

Circle the number that best describes how much you agree or disagree with each statement.

		Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
1.	As far as I'm concerned, I don't have any problems with cocaine that need changing.	1	2	3	4	5
2.	I think I might be ready for some self-improvement.	1	2	3	4	5
3.	I am doing something about the problems with cocaine that had been bothering me.	1	2	3	4	5
4.	It might be worthwhile to work on my problem with cocaine.	1	2	3	4	5
5.	I'm not the problem one. It doesn't make much sense for me to consider changing.	1	2	3	4	5
6.	It worries me that I might slip back on a problem with cocaine I have already changed so I am looking for help.	1	2	3	4	5
7.	I am finally doing some work on my problem with cocaine.	1	2	3	4	5
8.	I've been thinking that I might want to change something about myself.	1	2	3	4	5
9.	I have been successful in working on my problem with cocaine but I'm not sure I can keep up the effort on my own.	1	2	3	4	5

10.	At times my problem with cocaine is difficult, but I'm working on it.	1	2	3	4	5
11.	Trying to change is pretty much a waste of time for me because the problem with cocaine doesn't have to do with me.	1	2	3	4	5
12.	I'm hoping that I will be able to understand myself better.	1	2	3	4	5
13.	I guess I have faults, but there's nothing that I really need to change.	1	2	3	4	5
14.	I am really working hard to change.	1	2	3	4	5
15.	I have a problem with cocaine and I really think I should work on it.	1	2	3	4	5
16.	I'm not following through with what I had already changed as well as I had hoped, and I want to prevent a relapse of the problem with cocaine.	1	2	3	4	5
17.	Even though I'm not always successful in changing, I am at least working on my problem with cocaine.	1	2	3	4	5
18.	I thought once I had resolved the problem with cocaine I would be free of it, but sometimes I still find myself struggling with it.	1	2	3	4	5
19.	I wish I had more ideas on how to solve my problem with cocaine.	1	2	3	4	5
20.	I have started working on my problem with cocaine but I would like help.	1	2	3	4	5
21.	Maybe someone or something will be able to help me.	1	2	3	4	5
22.	I may need a boost right now to help me maintain the changes I've already made.	1	2	3	4	5
23.	I may be part of the problem with cocaine but I don't really think I am.	1	2	3	4	5
24.	I hope that someone will have some good advice for me.	1	2	3	4	5
25.	Anyone can talk about changing; I'm actually doing something about it.	1	2	3	4	5
26.	All this talk about psychology is boring. Why can't people just forget about their problems?	1	2	3	4	5
27.	I'm struggling to prevent myself from having a relapse of my problem with cocaine.	1	2	3	4	5
28.	It is frustrating, but I feel I might be having a recurrence of a problem with cocaine I thought I had resolved.	1	2	3	4	5
29.	I have worries but so does the next	1	2	3	4	5

	guy. Why spend time thinking about them?					
30.	I am actively working on my problem with cocaine	1	2	3	4	5
31.	I would rather cope with my faults than try to change them.	1	2	3	4	5
32.	After all I had done to try and change my problem with cocaine, every now and again it comes back to haunt me.	1	2	3	4	5

Appendix G

Timeline Followback
(TLFB)

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Super Bowl 1	Groundhog 2	3	4	5	6	7
C: Y N	C: Y N	C: Y N	C: Y N	C: Y N	C: Y N	C: Y N
8	9	10	11	Lincoln Bday 12	13	Valentines 14
C: Y N	C: Y N	C: Y N	C: Y N	C: Y N	C: Y N	C: Y N
15	President's Day 16	17	18	19	20	21
C: Y N	C: Y N	C: Y N	C: Y N	C: Y N	C: Y N	C: Y N
22	23	24	Ash Wed 25	26	27	28
C: Y N	C: Y N	C: Y N	C: Y N	C: Y N	C: Y N	C: Y N
29						
C: Y N						

Notes: _____
_____
_____

References

American Psychiatric Association (2013). *Diagnostic and statistical manual of mental disorders: DSM-5 (Fifth ed.)*. Arlington, VA: American Psychiatric Association.

Andrés, A., Saldaña, C., & Gómez-Benito, J. (2011). The transtheoretical model in weight management: Validation of the processes of change questionnaire. *Obesity Facts, 4*(6), 433.

Annis, H. M., & Davis, C. S. (1988). Assessment of expectancies. In D. M. Donovan, & G. A. Marlatt (Eds.), *Assessment of addictive behaviors* (84-111). New York: Guilford Press.

Baker, A. L., Kavanagh, D. J., Kay-Lambkin, F. J., Hunt, S. A., Lewin, T. J., Carr, V. J., & McElduff, P. (2014). Randomized controlled trial of MICBT for co-existing alcohol misuse and depression: Outcomes to 36-months. *Journal of Substance Abuse Treatment, 46*(3), 281–290. http://doi.org/10.1016/j.jsat.2013.10.001

Baker, A. L., Thornton, L. K., Hiles, S., Hides, L., & Lubman, D. I. (2012). Psychological interventions for alcohol misuse among people with co-occurring depression or anxiety disorders: A systematic review. *Journal of Affective Disorders, 139*(3), 217–229. http://doi.org/10.1016/j.jad.2011.08.004

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review, 84*(2), 191-215.

Beck, A. T., Rush, A. J., Shaw, B. F., & Emery, G. (1979). *Cognitive therapy of depression.* New York: Guilford Press.

Bektas, M., Ozturk, C., & Armstrong, M. (2010). Validity and reliability study of the Turkish version of the Decisional Balance Scale for adults. *Journal of Addictions Nursing, 21*(1), 6-13. doi:10.3109/10884601003628096

Belding, M. A., Iguchi, M. Y., Lamb, R. J., Lakin, M., & Terry, R. (1995). Stages and processes of change among polydrug users in methadone maintenance treatment. *Drug and Alcohol Dependence, 39*(1), 45-53. doi:10.1016/0376-8716(95)01135-L

Blume, A. W., Schmaling, K. B., & Marlat, G. A. (2001). Motivating drinking behavior change: Depressive symptoms may not be noxious. *Addictive Behaviors, 26*(2), 267–272. http://doi.org/10.1016/S0306-4603(00)00087-3

Brown, T. A., Campbell, L. A., Lehman, C. L., Grisham, J. R., & Mancill, R. B. (2001). Current and lifetime comorbidity of the DSM-IV anxiety and mood disorders in a large clinical sample. *Journal of Abnormal Psychology*, *110*(4), 585.

Burns, L., Teesson, M., & O'Neill, K. (2005). The impact of comorbid anxiety and depression on alcohol treatment outcomes. *Addiction, 100*(6), 787-796.

Caldwell, T. M., Rodgers, B., Jorm, A. F., Christensen, H., Jacomb, P. A., Korten, A. E., & Lynskey, M. T. (2002). Patterns of association between alcohol consumption and symptoms of depression and anxiety in young adults. *Addiction, 97*(5), 583-594.

Carbonari, J. P., & DiClemente, C. C. (2000). Using transtheoretical model profiles to differentiate levels of alcohol abstinence success. *Journal of Consulting and Clinical Psychology, 68*(5), 810-817. doi:10.1037/0022-006X.68.5.810

Centers for Disease Control and Prevention (CDC; 2015). *Suicide: Facts at a glance*. Retrieved from http://www.cdc.gov/violenceprevention/pdf/suicide-datasheet-a.PDF

Chen, H., Sheu, J., Percy, M. S., Brown, E. J., & Yang, R. (2006). The Chinese version of the Decisional Balance Scale: Further validation. *Nursing Research, 55*(4), 225-230. doi:10.1097/00006199-200607000-00002

Degenhardt, L., Hall, W., & Lynskey, M. (2001). Alcohol, cannabis, and tobacco use among Australians: A comparison of their associations with other drug use and use disorders, affective and anxiety disorders, and psychosis. *Addiction, 96*(11), 1603-1614. doi:10.1046/j.1360-0443.2001.961116037.x

Derogatis, L. R. (1993). *The Brief Symptom Inventory (BSI): Administration, scoring, and procedures manual, 3rd Ed*. Minneapolis, MN: National Computer Systems.

DiClemente, C. C., & Hughes, S. O. (1990). Stages of change profiles in outpatient alcoholism treatment. *Journal of Substance Abuse, 2*(2), 217-235. doi:10.1016/S0899-3289(05)80057-4

DiClemente, C.C., Prochaska, J.O., Fairhurst, S., Velicer, W.F., Velasquez, M., & Rossi J. (1991). The process of smoking cessation: An analysis of precontemplation, contemplation & preparation stages of change. *Journal of Consulting and Clinical Psychology, 59*, 295-304.

DiClemente, C. C., Carbonari, J. P., Montgomery, R. P., & Hughes, S. O. (1994). The Alcohol Abstinence Self-Efficacy Scale. *Journal of Studies on Alcohol, 55*(2), 141-148. doi:10.15288/jsa.1994.55.141

Eeckhout, C., Francaux, M., & Philippot, P. (2012). Exercise processes of change questionnaire: French validation. *Science & Sports, 27*(6), 333. doi:10.1016/j.scispo.2011.10.013

Fals-Stewart, W., O'Farrell, T. J., Freitas, T. T., McFarlin, S. K., & Rutigliano, P. (2000). The Timeline Followback reports of psychoactive substance use by drug-abusing patients: Psychometric properties. *Journal of Consulting and Clinical Psychology, 68*(1), 134-144. doi:10.1037/0022-006X.68.1.134

Field, C. A., Adinoff, B., Harris, T. R., Ball, S. A., & Carroll, K. M. (2009). Construct, concurrent and predictive validity of the URICA: Data from two multi-site clinical trials. *Drug and Alcohol Dependence, 101*(1), 115-123. doi:10.1016/j.drugalcdep.2008.12.003

Floyd, R. L., Sobell, M., Velasquez, M. M., Ingersoll, K., Nettleman, M., Sobell, L., . . . Nagaraja, J. (2007). Preventing alcohol-exposed pregnancies: A randomized controlled trial. *American Journal of Preventive Medicine, 32*(1), 1-10.

Furnham, A. (1986). Response bias, social desirability and dissimulation. *Personality and Individual Differences, 7*(3), 385-400. doi:10.1016/0191-8869(86)90014-0

Grant, B. F., Stinson, F. S., Dawson, D. A., Chou, S. P., Dufour, M. C., Compton, W., ... & Kaplan, K. (2004). Prevalence and co-occurrence of substance use disorders and independent mood and anxiety disorders: Results from the National Epidemiologic Survey on alcohol and related conditions. *Archives of General Psychiatry, 61*(8), 807-816.

Geller, J., Cockell, S. J., & Drab, D. L. (2001). Assessing readiness for change in the eating disorders: The psychometric properties of the readiness and motivation interview. *Psychological assessment, 13*(2), 189.

Glozah, F. N., Adu, N. A. T., & Komesuor, J. (2015). Assessing alcohol abstinence self-efficacy in undergraduate students: Psychometric evaluation of the Alcohol Abstinence Self-Efficacy Scale. *Health and Quality of Life Outcomes, 13*, 189.

Greenberg, P. E., Fournier, A. A., Sisitsky, T., Pike, C. T., & Kessler, R. C. (2015). The economic burden of adults with major depressive disorder in the United States (2005 and 2010). *The Journal of Clinical Psychiatry, 76*(2), 155-162.

Guo, B., Aveyard, P., Fielding, A., & Sutton, S. (2009). The factor structure and factorial invariance for the decisional balance scale for adolescent smoking. *International Journal of Behavioral Medicine, 16*(2), 158-163. doi:10.1007/s12529-008-9021-5

Kanfer, R., & Zeiss, A. M. (1983). Depression, interpersonal standard setting, and judgments of self-efficacy. *Journal of Abnormal Psychology, 92*(3), 319-329. doi:10.1037//0021-843X.92.3.319

Kim, H. (2013). Statistical notes for clinical researchers: Assessing normal distribution using skewness and kurtosis. *Restorative Dentistry & Endodontics, 38*(1), 52-54. doi:10.5395/rde.2013.38.1.52

Kim, S. S., Kim, S., & Gulick, E. E. (2009). Cross-cultural validation of a smoking abstinence self-efficacy scale in Korean American men. *Issues in Mental Health Nursing, 30*(2), 122-130. doi:10.1080/01612840802370582

Lovejoy, T. I., & Heckman, T. G. (2014). Depression moderates treatment efficacy of an HIV secondary-prevention intervention for HIV-positive late middle-age and

older adults. *Behavioral Medicine, 40*(3), 124–33. http://doi.org/10.1080/08964289.2014.893982

Marshall, S. J., & Biddle, S. J. H. (2001). The transtheoretical model of behavior change: A meta-analysis of applications to physical activity and exercise. *Annals of Behavioral Medicine, 23*(4), 229-246. doi:10.1207/S15324796ABM2304_2

Martinez, D., & Trifilieff, P. (2014, October 14). *Cocaine Vaccine: Research Review.* American Society of Addiction Magazine. Retrieved from http://www.asam.org/magazine/read/article/2014/10/15/cocaine-vaccine-research-review

McCarthy, C.J., Whittaker, T.A., Boyle, L.H., & Eyal, M. (2017). Quantitative approaches to group research: Suggestions for best practices. *The Journal for Specialists in Group Work, 42*(1), 3-16. doi: 10.1080/01933922.2016.1264520

McConnaughy, E. A., Prochaska, J. O., & Velicer, W. F. (1983). Stages of change in psychotherapy: Measurement and sample profiles. *Psychotherapy: Theory, Research & Practice, 20*(3), 368-375. doi:10.1037/h0090198

Miller, W. R., & Rollnick, S. (2013). *Motivational interviewing: Helping people change (3rd ed.)*. New York, NY: Guilford Press.

Mills, K.L., Deady, M., Proudfoot, H., Sannibale, C., Teesson, M., Mattick, R., & Burns, L. (2009). *Guidelines on the management of co-occurring alcohol and other drug and mental health conditions in alcohol and other drug treatment settings.* Sydney, Australia: National Drug and Alcohol Research Centre.

National Alliance of Mental Illness (NAMI; n.d.). *Depression*. Retrieved from http://www.nami.org/Learn-More/Mental-Health-Conditions/Depression

National Institute on Drug Abuse (NIDA; n.d.). *Prescription drug abuse: Stimulants.* Retrieved from https://www.drugabuse.gov/publications/research-reports/prescription-drugs/stimulants

National Institute on Drug Abuse (NIDA, 2015). *Cocaine: How is cocaine addiction treated?* Retrieved from https://www.drugabuse.gov/publications/research-reports/cocaine/what-treatments-are-effective-cocaine-abusers

Nederhof, A. J. (1985). Methods of coping with social desirability bias: A review. *European Journal of Social Psychology, 15*(3), 263-280. doi:10.1002/ejsp.2420150303

Office of National Drug Control Policy (2011). *How illicit drug use affects business and the economy.* Retrieved from https://www.whitehouse.gov/ondcp/ondcp-fact-sheets/how-illicit-drug-use-affects-business-and-the-economy

Office of National Drug Control Policy (2014, April). *Consequences of illicit drug use in America.* Retrieved from https://www.whitehouse.gov/sites/default/files/ondcp/Fact_Sheets/consequences_of_illicit_drug_use_-_fact_sheet_april_2014.pdf

Pace, C. A., & Samet, J. H. (2016). Substance use disorders. *Annals of Internal Medicine, 164*(7), 50–63. http://doi.org/10.7326/AITC201604050

Penberthy, J. K., Hook, J. N., Hettema, J., Farrell-Carnahan, L., & Ingersoll, K. (2013). Depressive symptoms moderate treatment response to brief intervention for prevention of alcohol exposed pregnancy. *Journal of Substance Abuse Treatment, 45*(4), 335–342. http://doi.org/10.1016/j.jsat.2013.05.002

Pettinati, H. M., O'Brien, C. P., & Dundon, W. D. (2013). Current status of co-occurring mood and substance use disorders: A new therapeutic target. *American Journal of Psychiatry,170*(1), 23-30. doi:10.1176/appi.ajp.2012.12010112

Prochaska, J. Q, & DiClemente, C. C. (1982). Transtheoretical therapy: Toward a more integrative model of change. *Psychotherapy: Theory, Research and Practice, 20*, 161-173.

Prochaska, J. O., & DiClemente, C. C. (1984). *The transtheoretical approach: Crossing traditional boundaries of therapy.* Homewood, Ill: Dow Jones-Irwin.

Prochaska, J. O., DiClemente, C. C., & Norcross, J. C. (1992). In search of how people change: Applications to addictive behaviors. *American Psychologist, 47*(9), 1102-1114. doi:10.1037/0003-066X.47.9.1102

Prochaska, J.O., Redding, C.A., & Evers, K.E. (2013). The transtheoretical model and stages of change. In K. Glanz, B.K. Rimer, & K. Viswanath, (Eds.), *Health Behavior and Health Education: Theory, Research, and Practice, 4th ed.* (97-121). San Francisco, CA: Jossey-Bass.

Prochaska, J. O., & Velicer, W. F. (1997). The transtheoretical model of health behavior change. *American Journal of Health Promotion, 12*(1), 38-48.

Prochaska, J. J., Rossi, J. S., Redding, C. A., Rosen, A. B., Tsoh, J. Y., Humfleet, G. L., ... & Hall, S. M. (2004). Depressed smokers and stage of change: Implications for treatment interventions. *Drug and alcohol dependence, 76*(2), 143-151.

Prochaska, J. O., Velicer, W. F., Rossi, J. S., Goldstein, M. G., Marcus, B. H., Rakowski, W., ... & Rossi, S. R. (1994). Stages of change and decisional balance for 12 problem behaviors. *Health psychology, 13*(1), 39.

Prochaska, J. O, Velicer, W. F., DiClemente, C. C, & Fava, J. S. (1988). Measuring processes of change: Applications to the cessation of smoking. *Journal of Consulting and Clinical Psychology, 56,* 520- 528.

Prochaska, J. O., Velicer, W. F., DiClemente, C. C., & Fava, J. (1988). Measuring processes of change: Applications to the cessation of smoking. *Journal of Consulting and Clinical Psychology, 56*(4), 520.

Prochaska, J. O., Velicer, W. F., Guadagnoli, E., Rossi, J. S., & DiClemente, C. C. (1991). Patterns of change: Dynamic typology applied to smoking cessation. *Multivariate Behavioral Research, 26*(1), 83-107.

Rosenbloom, D. (1991). *A transtheoretical analysis of change among cocaine users* (Doctoral dissertation). Retrieved from University of Rhode Island Digital Commons. (AAI9202994)

Smith, J. P., & Tran, G. Q. (2007). Does negative affect increase change readiness among college hazardous drinkers? *Addictive Behaviors, 32*(10), 2281–2285. http://doi.org/10.1016/j.addbeh.2007.01.019

Sobell, L. C., & Sobell, M. B. (1980). Convergent validity: An approach to increasing confidence in treatment outcome conclusions with alcohol and drug abusers. *Evaluating Alcohol and Drug Abuse Treatment Effectiveness: Recent Advances,* 177-183.

Sobell, L. C., & Sobell, M. B. (1996). Alcohol abuse and smoking: Dual recoveries. *Alcohol Research and Health, 20*(2), 124.

Sobell, L. C., Brown, J., Leo, G. I., & Sobell, M. B. (1996). The reliability of the Alcohol Timeline Followback when administered by telephone and by computer. *Drug and Alcohol Dependence, 42*(1), 49-54.

Strong, D. R., Uebelacker, L., Schonbrun, Y. C., Durst, A., Saritelli, J., Fokas, K., … Apodaca, T. R. (2012). Development of a brief motivational intervention to facilitate engagement of smoking cessation treatment among inpatient depressed smokers. *Journal of Smoking Cessation, 7*(1), 4–11. http://doi.org/10.1017/jsc.2012.3

Stotts, A. L., DiClemente, C. C., Carbonari, J. P., & Mullen, P. D. (1996). Pregnancy smoking cessation: A case of mistaken identity. *Addictive behaviors, 21*(4), 459-471.

Stotts, A. L., Schmitz, J. M., Rhoades, H. M., & Grabowski, J. (2001). Motivational interviewing with cocaine-dependent patients: A pilot study. *Journal of Consulting and Clinical Psychology, 69*(5), 858.

Sullivan, L. E., Fiellin, D. A., & O'Connor, P. G. (2005). The prevalence and impact of alcohol problems in major depression: A systematic review. *The American Journal of Medicine,118*(4), 330-341. doi:10.1016/j.amjmed.2005.01.007

Tabachnick, B. G., 1936, & Fidell, L. S. (2013). *Using multivariate statistics (6th ed.).* Boston: Pearson Education.

Tambling, R. B., & Ketring, S. A. (2014). The R-URICA: A confirmatory factor analysis and a revision to the URICA. *Contemporary Family Therapy, 36*(1), 108-119. doi:10.1007/s10591-013-9279-x

Tsoh, J. Y., & Hall, S. M. (2004). Depression and smoking: From the transtheoretical model of change perspective. *Addictive Behaviors, 29*(4), 801–805. http://doi.org/10.1016/j.addbeh.2004.02.011

Velasquez, M. M., Carbonari, J. P., & DiClemente, C. C. (1999). Psychiatric severity and behavior change in alcoholism: The relation of the transtheoretical model variables to psychiatric distress in dually diagnosed patients. *Addictive Behaviors, 24*(4), 481-496. doi:10.1016/S0306-4603(98)00103-8

Velasquez, M. M., Crouch, C., Stephens, N. S., & DiClemente, C. C. (2016). *Group treatment for substance abuse: A stages-of-change therapy manual.* New York: Guilford Press.

Velasquez, M. M., Gaddy Maurer, G. Crouch, C., & DiClemente, C. C. (2001). *Group treatment for substance abuse, second edition: A stages-of-change therapy manual.* New York: Guilford Press.

Velasquez, M. M., Stotts, A., von Sternberg, K., Dodrill, C. L., & Sampson, M. (2009, January). A Transtheoretical Model Group Therapy for Cocaine. 13th Annual Society for Social Work and Research Conference, New Orleans, LA.

Velicer, W. F., Prochaska, J. O., Fava, J. L., Norman, G. J., & Redding, C. A. (1998). Smoking cessation and stress management: Applications of the transtheoretical model. *Homeostasis, 38,* 216-233.

Wang, J., Kelly, B. C., Booth, B. M., Falck, R. S., Leukefeld, C., & Carlson, R. G. (2010). Examining factorial structure and measurement invariance of the brief symptom inventory (BSI)-18 among drug users. *Addictive Behaviors, 35*(1), 23-29. doi:10.1016/j.addbeh.2009.08.003

Wells-Parker, E., Dill, P., Williams, M., & Stoduto, G. (2006). Are depressed drinking/driving offenders more receptive to brief intervention? *Addictive Behaviors, 31*(2), 339–350. http://doi.org/10.1016/j.addbeh.2005.05.011

Worthington, J., Fava, M., Agustin, C., Alpert, J., Nierenberg, A. A., Pava, J. A., & Rosenbaum, J. F. (1996). Consumption of alcohol, nicotine, and caffeine among depressed outpatients: Relationship with response to treatment. *Psychosomatics, 37*(6), 518-522.

Yang, C. H., Choi, S. H., Kim, J. S., Ryu, Y. H., Lim, Y. J., Kim, M. S., . . . Lee, M. Y. (2017). The effects of acupuncture stimulation for brain activation and alcohol abstinence self-efficacy: Functional MRI study. *Evidence-Based Complementary and Alternative Medicine,* 2017, 1-7. doi:10.1155/2017/2850124

Zingg, C., Schmidt, P., Küfner, H., Kolb, W., Zemlin, U., & Soyka, M. (2009). The relationship between self-efficacy and abstinence from alcohol after outpatient and inpatient treatment-a two year follow-up. *Psychotherapie, Psychosomatik, Medizinische Psychologie, 59*(8), 307.